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The Practical Teacher

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The
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"Knowledge is proud that he has learned so much,
Wisdom is humble that he knows no more."—COWPER.

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WELL-KNOWN TEACHERS AT WORK.

XVIII. MR. RICHARD SYKES,

Gillespie Road School, Highbury, N.

A TEN minutes' walk from Finsbury Park Station, through quiet streets mainly occupied by the great lower middle-class, brings us to Gillespie Road School. On entering the boys' playground we notice two circular flower-beds in the asphalt, destitute of any protection, yet filled with autumn flowers in full bloom—a detail which speaks well for the behaviour of the lads, who are generally vandals as far as flowers are concerned.

The Boys' School is the upper floor of the building, and, in the master's room, we find Mr. Sykes engaged in compiling one of the many statistical returns which are continually required by the London School Board.

We explain the object of our visit, and are met with a cordial welcome. While waiting for Mr. Sykes to complete the return, we notice a science cupboard well filled with apparatus, for teaching mechanics, supplied by the Board; supplemented by many other well-made models, constructed by the boys. Some of these are very ingenious; for example, a crane, made from the works of an old clock, very neatly finished; a model of triple-expansion engines with rocking cylinders, constructed of reels; a windmill; micrometer screws; &c.

"You teach mechanics as a special subject, then?" we inquire.

"Yes, we have taken it for several years, and have never had a failure in it. I think it is the very best subject for boys. It not only teaches them valuable facts, but affords wide scope for the use of their constructive faculties. It is very popular with the boys, and the models they make are, as you see, evidence that they both understand and are interested in their work. We receive all attempts, however crude; though, of course, we have to discriminate as to those which find place in our permanent apparatus."

"What other specific do you take, Mr. Sykes?"

"Algebra. That subject, though not so practically useful, is very valuable as a means of mental training."

The room also contains a well-filled museum, the contents of which have been contributed almost entirely by the boys, and a good library.

"I suppose the lads appreciate the advantage of having good works to read?"

"Undoubtedly. Every boy in the upper part of the school is anxious to be on the list, but, unfortunately, we have not sufficient books, so the privilege of membership is only bestowed on those whose attendance and work at school is of special merit. The use of such books goes a long way to create a good taste, and to prevent boys from reading the pernicious literature which is unfortunately so common.

"We will walk through the school now, if you like," continued Mr. Sykes, "and I can point out to you anything of interest."

The school is built on the class-room principle, without a central hall. It was erected in 1879, and was then considered one of the finest in London.

PLAN.

We proceed to Standard I. room.

"We never have a large Standard I.," says Mr. Sykes; "we take about 80 boys each year from the Infants' Department and they are nearly all fit for Standard II."

"How do your children attend?" we ask.

"Very well. Here is the attendance board. You see we have 400 on the roll (although our accommodation is only 360), and there are 382 present this morning, that is a little over 95 *per cent.*"

"Surely this is exceptional, is it not?"

"No, it is rather above the average. Last week our percentage for the school was 94·5; for last quarter it was 92·4; and for the whole of last year—ending April 30—it was 92·8. This is rather below our annual average, but the decline may be attributed to the prevalence of the influenza last winter."

"How do you manage to secure such good attendance?"

"Well," with a quiet smile, "primarily by making up our minds to. Boys are generally what you like to make them. We set ourselves the task of getting every boy to school every time it is opened, and pursue this object with persistent determination. Of course, we do not obtain cent. per cent. of attendance, but still, by setting ourselves as high a standard as posssible, we *do* obtain a very creditable result. I should point out to you that we have one great advantage over some of the other London schools, most of our boys are very respectable.

"We rarely admit any boys but those who have passed through the Infants' Department; our accommodation will not permit it. I have to refuse hundreds in the course of a year.

"From the time a boy enters the school, the fact is constantly impressed upon him that he must attend regularly and punctually; and no excuse for absence is recognised but that of genuine illness.

"In any cases of irregular attendance, I generally manage to see the parents and point out to them the advantages of habits of regularity and punctuality, and the disadvantages of absence from school; and also that irregular attendance always means, sooner or later, that the boy will have to be put back a Standard. Most parents are sensible enough to see that it is to their own advantage to send their children regularly.

"Another thing on which regularity depends is punctuality. Our schoolbell rings at a quarter to nine and a quarter to two, and at that time we expect all boys to be in their line in the yard. They at once march to their respective rooms, and the few minutes available are invaluable for the preparation of the work of the session.

"The bell rings again at five minutes to the hour, and exactly at nine and two the doors are closed and the rolls taken. All boys one second after that are late, and report themselves to me. I generally take their names, and warn them against a future repetition of the offence. The result is, that we have very few boys late. This morning there were three, and very frequently we have none at all. My experience is, that a punctual boy is a regular boy.

"Last year we had 29 medals for boys not absent, or late once; and 110 prizes for boys not absent, or late more than 15 times. The year before, the numbers were, 36 medals and 137 prizes.

"Another inducement to regularity is this. Two of our managers presented us with pictures—that is one (indicating a large framed picture), the other is in the upper part of the school. These are held for the week by the classes securing the highest percentage of attendance for the preceding week. This friendly rivalry between the classes works very well, and the boys take a keen interest in the competition."

"Such regular attendance as yours must make the teaching much easier than in some schools?"

"Yes, of course; it enables us to teach more thoroughly and to pay more attention to cultivating the intelligence, which, after all, is the main object of education."

In Standard II. room a reading lesson is in progress, and the enunciation is singularly clear and distinct.

"Which method of teaching reading do you use?"

"The phonic in the lower standards, and the alphabetic principally in the others. Our reading has always been good. In the old individual examination days we did not have a failure for years, although the late Mr. Fussel took a very high standard."

"What do you think of the present system of examination?" we inquire.

"I think the present plan a great improvement upon the one it succeeds. Liberty of classification is accorded us, and we use it with care and caution, having only one object in view—namely, the best educational interests of each boy. We examine carefully each boy as he enters the school, and always place him in as high a standard as we possibly can. After the annual examinations we re-present boys who, in our judgment, have not the ability or knowledge to enable them, with comfort to themselves and teacher, to advance to the next standard. If, however, we have any hope that a boy, by fair teaching and an absence of pressure, might be able to pass in a higher standard, we let him try for one or two quarters in the higher standard before we make our final decision as to whether we shall promote him or retain him in the lower standard.

"I am not sure," said Mr. Sykes, in reply to a question, "that more boys are re-presented than under the old system, and especially if we consider the upper standards only. We are very careful to classify, properly, Standards I. and II. We find that if children are thoroughly taught in these standards, and well grounded in the fundamentals—reading, writing, and arithmetic—we have little trouble afterwards."

"You are not altogether satisfied with the present system!" we remark.

"No. The set annual examination is an obstacle to a proper classification of the children, and also to thoroughly intelligent, systematic, and methodical teaching. A higher standard of attainments is required now than formerly. Every boy must be well-equipped in order to pass successfully through the annual examination. The teacher must have constantly before his mind the annual ordeal, and must shape his teaching to meet it. We have little opportunity for experiment, for practising new methods, and introducing new subjects. There is yet little play for individuality. All schools must, to a great extent, march on the same lines as formerly."

"What would you suggest as a remedy?"

"Intermittent visits of inspection and advice. There are few schools, in my opinion," said Mr. Sykes, "where the teachers are not doing good and honest work throughout the whole of the school year. A properly-qualified inspector would, by visiting at intervals during the school year, be better able to

gauge the merits and work of a school than by a formal inspection as at present."

Passing through Standard III. room we proceed to the upper part of the school, where the work we see is of a very high character.

The boys appear, with but very few exceptions, scrupulously clean and neat, and Mr. Sykes informs me that personal cleanliness is as much insisted on as regularity, and that he makes regular inspections of the classes during the week; all boys exhibiting any carelessness in their personal appearance being noted, and in any bad case the boy has to present himself to the head-master, for a week or a fortnight, before being allowed to join his class.

A question addressed by Mr. Sykes to one of the boys, as to his ability to do some particular work, leads us to remark that it must be difficult for a head-master to keep in touch with all the boys and their work.

R. Sykes.

"To a certain extent, it certainly is; but, still, a head-master should always know exactly what the classes are doing, and how most of the individuals in the classes are progressing."

"How do you manage to do this?"

"I give the greater part of each day to one of the classes, keeping the same day each week for the same class. I hold a short examination on the work that has been done, and mark the work myself as far as possible. The results are each week entered in a note-book. The best boys get a few words of praise and encouragement, and the backward boys a little advice. The names of the latter are taken down, and, at the next examination, it is easy to see whether they have made as much improvement as the rest of the class. By this means, I always know what boys require special attention.

"Here is another means of finding out the individual character, and the capabilities of a boy," said Mr. Sykes, picking up an exercise-book from a heap awaiting the master's inspection.

"This is a home-work book. We insist on all boys in the upper part of the school doing home work. We do not set much, and we do not give the boys any new work to prepare. They have a short exercise on something already done at school—a sum or two, writing, a map, etc.—and, what is set, we expect done well. I believe strongly in the value of home-lessons. In the first place, the work is done away from the master's eye, and the school surroundings, and supplies an excellent criterion of a boy's trustworthiness and interest in his work.

Then, again, the little work done at home, in the evening, helps to give a lad a bias towards some kind of study when he no longer attends school; and, finally, the home-work book is a very valuable link between the parent and teacher. It is, in many cases, the only means a parent has of judging what is done at school."

"Do the parents of your boys take an interest in this home-work?"

"Yes, decidedly, excepting a very few cases. Occasionally, where the boy has work in the evening and his wages are required at home, we are bound to excuse his not conforming to the rule; but I do not think we have half-a-dozen boys whose parents object to their doing the home-work. There are still a few who see no good in education, but they are rapidly decreasing. I had an instance brought under my notice the other day. One of the boys taking mechanics had come without his book. It seems that he had, in enumerating the properties of matter, written down the fact that 'all matter is indestructible.' This he pointed out to his father, who disputed the truth of it, and who, on finding himself beaten in the argument that ensued, seized the book and threw it on the fire to demonstrate, as he remarked, that '*that book* was, at any rate, destructible.'"

"On Friday afternoon I have all the home-work books of the school collected, and examine the week's work, assigning to each book a mark—'Excellent,' 'Pass,' or 'Fail'—and the classes are arranged in order of merit according to the number of 'Excellents' obtained."

Mr. Sykes is here called away on one of the many matters of business requiring his attention, and we spend a few minutes in examining a large canvas-backed frame (which we notice in each of the upper standard rooms) on which was mounted a number of drawings—maps, original designs, &c.—executed by the boys of the class.

"Your boys seem fond of drawing," we remark, as Mr. Sykes rejoins us.

"Yes; we have always had the highest award for drawing, and I think it is the most popular of the school subjects; but what you are looking at is done principally at home, and is, for the most part, original. We encourage originality and construction in

drawing, and in some cases the boys show real genius."

We inspected, afterwards, a collection of works which had been exhibited at the Board's Annual Art Exhibition. They comprised drawings from fruit, flowers, shading from casts, groups of models, and original designs in freehand. They were excellent in proportion and finish, and many of them had taken prizes.

"Here is another means of cultivating the observation," remarks Mr. Sykes. This was a large chart recording the barometer and thermometer readings, direction and force of wind, rainfall, &c., kept by the lads themselves.

In the VI. and VII. Standard room we find the class singing, and are struck by the sweetness and purity of tone.

"Our singing has always been very good. We have many visitors come to hear it. Some time ago Mr. Evans, the late Board Inspector, came here with an Australian Inspector, and examined the school. This is his report:—

'The Government Inspector of Music from Victoria having expressed a desire to accompany me to one of our schools to see the result of the music teaching in Sol Fa and Staff Notation, I took him to this school, because it is one of the schools in which both notations are taught. The boys passed an excellent examination in both notations. The music-teaching in Standard II. is the best I have ever seen, and deserves special mention.—J. EVANS.'

"Most of these boys," continues Mr. Sykes, "are in choirs. In fact, we may say we supply nearly all the churches, &c., near here with choristers. One of our boys recently took, in open competition, an appointment of head chorister in Derry Cathedral—a valuable post.

"At present, we are practising for a school concert which is shortly to be given. We have very large audiences to hear us. On the last occasion we had over 1,100, and had to refuse hundreds admission. The parents take a very great interest and pride in the performances."

In this room our attention is called to the "Honour Board," on which are the names of boys who have taken scholarships. This exhibits scholarships to the value of over £500 taken since 1887. On two occasions, we are told—in 1889 and 1891—a boy from this school took the first place in the London Board Scholarships, obtained in open competition after three searching examinations.

"Do you do anything for the boys out of school-hours?" we inquire.

"Oh yes, though that is attended to by my assistants. We have a football-team which played twenty matches last season and won sixteen, and a cricket-club which was not beaten at all this summer in the twelve matches they played. The boys also attend the swimming baths, and are taught by the masters. So you see we pay attention to the old adage 'A sound mind in a healthy body.'"

"You think such games beneficial to the school?"

"Most certainly. The tendency of the last twenty years has been to overwork the mind—often at the expense of the body. Physical education is, in my opinion, little less important that mental development. We do not want to turn out of our school such monstrosities as Lord Wolsely describes: 'Tom-noddies, all heads and no bodies.' Besides, the competition in such games strengthens the moral character of the boys."

"How has Free Education affected your school?"

"I have always been an advocate for Free Education. The political and social reasons for it are, in my opinion, unanswerable. One argument urged by its supporters I never accepted. It was confidently stated that it would materially improve the attendance. In our school, it has had very little effect. Our percentage of attendance is about the same now as before the passing of the Act. It was thought that a school like ours, which charged a high fee and was attended by children of well-to-do parents, would suffer by the abolition of the fee. Our experience is against this. The class of children appear to be exactly the same as before. There was a slight feeling amongst a few parents against free schooling. It soon, however, evaporated; and I believe the school is more popular than ever."

"I see in each room a syllabus of religious knowledge. I should like to know your opinion of the Religious Teaching in Board Schools?"

"I am strongly in favour of Religious Teaching in Board Schools. For fifteen years I was Head Master of a Church of England School, and always secured the best reports. I believe, however, that the religious teaching in Gillespie Road School is more systematically and thoroughly given. Catechisms and religious dogmas, of course, we do not teach; and I think this is to the advantage of the moral and spiritual life of the children. It always appeared to me folly to attempt to instruct little

TIME TABLE.—GILLESPIE ROAD SCHOOL, HIGHBURY, N., 1892-3.

MORNING.

Day.	Class. / Standards.	9—9.15.	9.15—9.45.	9.45—9.50.	9.50—10.30.	10.30—11.	11—11.15.	11.15—11.55.	11.55—12.
Monday.	VI. & VII.	Homework.	Religious Instruction.	Registers Closed.	Arithmetic	Geography	Singing, Tables, or Drill.	Algebra	Dismissal.
	V.				Arithmetic	Geography		Reading	
	IV.				Arithmetic	Reading		Dictation	
	III.				Arithmetic	Reading		Writing	
	II.				Arithmetic	Reading		Dictation	
	I.				Reading	Arithmetic		Singing	
Tuesday.	VI. & VII.				Arithmetic	English		Algebra	
	V.				Arithmetic	English		Reading	
	IV.				Arithmetic	Reading		Composition	
	III.				Arithmetic	Reading		Writing	
	II.				Arithmetic	Reading		Writing	
	I.				Reading	Writing		Arithmetic	
Wednesday.	VI. & VII.	Prayers.			Arithmetic	Geography		Algebra	
	V.				Arithmetic	Geography		Writing	
	IV.				Arithmetic	Reading		Drill	
	III.				Arithmetic	Reading		Writing	
	II.				Arithmetic	Reading		Dictation	
	I.				Reading	Arithmetic		Geography	
Thursday.	VI. & VII.				Arithmetic	English		Algebra	
	V.				Arithmetic	English		Reading	
	IV.				Arithmetic	Reading		Singing	
	III.				Arithmetic	Reading		Writing	
	II.				Arithmetic	Reading		Writing	
	I.				Reading	Arithmetic		Drill	
Friday.	VI. & VII.	Mark Registers.			Arithmetic	Geography		Singing	
	V.				Arithmetic	Geography		Singing	
	IV.				Arithmetic	Reading		Dictation	
	III.				Arithmetic	Reading		Singing	
	II.				Arithmetic	Reading		Drill	
	I.				Reading	Geography		Drill	

Arithmetic includes five or ten minutes Mental Arithmetic.

AFTERNOON.

2—2.15.	2.15—2.45.	2.45—3.15.	3.15—3.30.	3.30—4.	4—4.20.	4.20—4.30.
Registers Closed.	Mechanics	English	Singing or Drill.	Composition	Repetition	Homework, Prayers, and Dismissal.
	Mechanics	Composition		Arithmetic	Repetition	
	English	Reading		Arithmetic	Geography	
	English	Arithmetic		Geography	Object Lesson	
	Geography	Spelling		Object Lesson	Reading	
	Reading	Writing		Arithmetic	Geography	
	Drawing			Reading	Writing	
	Drawing			Geography	Dictation	
	Drawing			Geography	Reading	
	Drawing			English	Geography	
	Drawing			English	Geography	
	Drawing			Arithmetic	Object Lesson	
Spelling, &c.	Mechanics	English		Reading	Composition	
	Mechanics	Arithmetic		English	Reading	
	English	Arithmetic		Geography	Drill	
	English	Reading		Arithmetic	Geography	
	Reading	English		Dictation	Geography	
	Reading	Writing		English	Arithmetic	
	Drawing			Geography	Dictation	
	Drawing			Reading	Drill	
	Drawing			English	Geography	
	Drawing			Geography	Object Lesson	
	Drawing			English	Drill	
Mark Registers.	Drawing			Reading	Geography	
	Geography	Reading		Object Lesson	Drill	
	Composition	Mechanics		Reading	Object Lesson	
	Arithmetic	English		Object Lesson	Drill	
	Arithmetic	Reading		Object Lesson	Singing	
	Writing	English		Dictation	Object Lesson	
	Writing	English		Dictation	Object Lesson	

English = Grammar or Repetition.

children in the difficult and abstruse doctrines of the Churches. You will find, in the Board Syllabus for Scripture, certain chapters and verses are selected for the children to learn. These contain, as a rule, some valuable practical lesson; and the religious teaching of the Board is devoted more to explaining the morality taught by Christ, than to expounding special dogmas."

"You have examinations in Scripture, have you not?"

"Yes. We have been very successful in these examinations. All schools select a certain percentage of the upper standards for the competitive examination. Every boy sent in by us last year obtained either a prize or certificate. The questions sent are very searching, requiring much thought and accurate knowledge to answer properly.

Personally, I take a special interest in the Bible lessons. Regularly I give three or four lessons a week to the upper standards. I feel, in these lessons, that I can read the boys' hearts as well as minds. I can infuse a religious spirit, and show the children the beauty of a life patterned after Christ's, and can beget a better moral tone."

Once more seated in the master's room, Mr. Sykes kindly gives us a few historical facts which may interest our readers.

He is by birth a Yorkshireman, and was trained at York College. On leaving college he took charge of the National School, Hyson Green, Nottingham, where he remained for upwards of fifteen years, working the school to a high state of efficiency and success.

In 1879 he came to London, as head master of Gillespie Road School, then building, and commenced work in temporary premises near by. From the time the school was opened it has always taken rank as one of the best in London. It has always had the "Excellent" Merit Grant, and, since that was abolished, the highest mark obtainable.

The last report on the school runs as follows:—

"This school fully maintains its high reputation. Discipline is thoroughly good, and the instruction throughout in both elementary and class subjects is marked by thoroughness, accuracy, and intelligence. The boys take a keen interest in their work, and both Algebra and Mechanics are very well taught.

"H. F. Dibben, H.M.I."

Of Mr. Sykes' work out of school, we need say little.

His untiring energy for the advancement of the profession, both in the curriculum of school work and in the status of teachers generally, and in his advocacy of real education as opposed to mere "cram" and instruction, are well known to all Educationists.

He stands in the front rank of those, who, by indomitable perseverance, have raised the social position of teachers from the level of the old "Dame School" teacher, to the status of the present day.

One of the earliest and most ardent advocates of the formation of the National Union—its President in 1882 and again Deputy President in 1891—a Trustee of the Teachers' Orphanage—he has earned the respect and gratitude of all teachers.

Mr. Sykes is a man of commanding presence, and strong individuality, an eloquent speaker and keen debater, of genial good nature and kindliness, and his character is reflected in the excellence of his school, and in the bright and cheerful tone which pervades it.

We bid Mr. Sykes adieu, and as we pass through the yard, where a class is going through some physical exercises, we cannot help regretting that our lot did not, in youth, fall in such pleasant places as that of some of these London lads.

TACT

IN THE BUSINESS OF SCHOOL-KEEPING.

By Richard Balchin.

An experience of some years as assistant master has taught me that many a young man, leaving college full of zeal in his work, and determined to carry into practice the excellent advice given him in his college lectures, has had all his beautiful ideals shattered, solely because of his unfortunate appointment under a Head, whose one aim is to get a "good report," and so earn a "big grant."

What must be the feelings of such a young enthusiast, who, upon his entrance into a large London Board School, is met by his Head with the remark: "You must understand that unless you pass at least 95 per cent. of your boys, you are no use here?" This is no fancy picture. I know it to be a fact. And so do many assistants.

With a view of mitigating the unhappiness of assistants who may have the misfortune to be placed in the above, or similar positions, I propose giving some scraps of advice under the heading:—

"Tact in the management of Heads by assistants."

I will begin by describing various types of Heads, and how to manage them. Our first type shall be:—

The very exalted Head; the "superior person" who is continually "taking steps to maintain his position."

An intelligent assistant can generally "see through" this character, with the utmost clearness. We—and here I imagine myself back to my old assistant-days—find him perfectly transparent. We know him quite well. We have gauged and assessed him at the true worth, which is, however, a very low figure. He may "pile it on" and "on," but it is of no use. We see through all his ridiculous antics and outward shows of petty bombast, and find beneath it all—nothing. No culture, very little of even book-learning; no originality, and no force of character. Probably he is himself fully sensible of these negative characteristics. Hence his amazing efforts to make up for the deficiency by an exhibition of "make-believes." It is said of one of our recent kings, that when you took off his coat, there were his trousers and waistcoat; and that when you took off these, there was positively nothing.

I attended church a short time since, when the clergyman made a lengthy and most piteous appeal for money for the poor of his district. He seemed so in earnest that he almost wept. But among the vast congregation there was shed no sympathetic tear, nor was there heard a single responsive sob; no, not even from that "aged pilgrim" who sits in

the front row and has regular relief. And why? Simply because the preacher was known.

I know from experience how hard a thing it is to patiently endure all the petty annoyances which this Head causes, in the various steps he considers himself justified in taking, in order to maintain his position. And yet I have felt a certain compassion for him, when observing his many laborious and often futile endeavours to pose as a very superior person. He need not really give himself all this trouble. We assistants have no desire to step out of our proper sphere and encroach upon the rights and privileges naturally appertaining to the position of our commanding officer. With such a Head, our great wish is simply to be let alone. If he will not, or can not, give us any friendly sympathy and aid, then, for heaven's sake, let him stand off, and leave us to our work. But, of course, he will not stand off. He will not let us alone. On the contrary, he will be always interfering with unnecessary advice and pestering us with utterly useless examinations, which only waste the time of the class.

Well, what is the assistant to do in such a case?

I would say, don't trouble yourself about the sympathy of your Head. Leave him, and turn to your boys. Throw yourself upon them. Make yourself one with them. Join in their football, in their cricket, in their swimming. Strike up with them a mutual friendship. You will find a greater happiness in their young and fresh affections than you would ever get from the cold regard of an unsympathetic Head. At least, this is my experience.

But there is another and totally different type of Head Master. I have met him and seen him at work in his school, but have never, I am glad to say, had the misfortune to be under him. He is—

THE DRY, DRAWLING, DROWSY HEAD; SEEMS TO BE ALWAYS INTONING; LETS NO LAD SMILE.

I have a vivid remembrance of such a character. He is not a bad man. Oh, no. He is really a good man — a well-meaning man, who would do no one harm willingly. He is, moreover, a very religious man; but his religion has its seat neither in the head nor in the heart; but entirely in the liver. He is dyspeptic and bilious constitutionally—always was so from a child, though, as a matter of fact, he never *was* a child—was born an old man to start with—never played as a child—never thought as a child. While other boys were romping, rushing, shouting, full of glee and full of fun, he sat in a gloomy corner and read "Harvey's Meditations among the Tombs"—a most unnatural occupation for one so young. As a pupil-teacher he was an extremely proper little old man, somewhat priggish. A fair student, but of books only. Entirely lacking in originality of thought. On no account venturing outside the well-worn tracks of an ancient theology, but believing what his grandmother believed, and because she believed it.

Such a man, because of the undeniable rectitude of his moral and religious character, is appointed to the mastership of a London Board School straight from that of a small Church School. It is in the former position I have met him. I do not know what was the state of his school when he entered upon his duties some five or six years ago; but *now*, everything about him seems to bear the impress of his own somewhat gloomy nature. He has a most solemn, woe-begone appearance; so have the maps, the pictures, the walls, the windows, the blinds, and the very desks. His face has never been known to brighten up into a smile—neither have those of his boys, apparently, who all seem to have taken an unusually large dose of a nauseous medicine. He gives his lessons in a whining, drawling voice, as if intoning a church service, and one fully expects to hear him conclude with a long-drawn-out and sevenfold "amen." The boys catch his style and answer in the same monotonous wail.

What an entirely unsuitable, nay, most pernicious place is this for a number of fresh young natures to receive their early training! Better by far let the children run about wild, and come under the natural influence of the fields and the lanes than compel them to pass their time among the dull and gloomy surroundings of such a so-called school. And what shall we say of the young assistant who comes fresh from college and finds himself in such a dull, dreary spot? My advice is, be careful, very careful, not to catch the contagion which hangs about this dismal swamp. Disinfect the place. Sunshine is here the best disinfectant—the sunshine which streams in at the windows, and the sunshine which flows from your own bright and cheery nature. As for the room, set a boy to clean the maps and pictures; persuade the school-keeper to clean the windows; have the desks dusted before using them. Let no boy remain in his seat having a dirty face or dirty boots. So far as the boots are concerned, it is a good plan to have some blacking and a set of brushes at the school. If a boy comes with dirty boots set him to clean one boot, but leave the other dirty, so that the contrast between cleanliness and dirt may appear the more striking.

But, above all, put a stop to the habit the boys have contracted of drawling out their answers. Speak in a brisk, lively tone yourself. If you can—as a disciplinarian—afford it, occasionally make a joke, and set the room in a roar of laughter.

NEW COMPOSITION STORIES.—STANDARD V.

Suitable for "Unseen Tests" in Reading also.

1.

MEMORY IN THE DOG.—Every one knows that the dog has a good memory, but it would be hard to tell how far back its recollection of persons and things can go. Here is a touching story that throws some light on this point. A gentleman being unable to keep his dog in his London house, gave it away when it was a twelvemonth old. Eight years afterwards it was restored to its original master. At first it looked upon him simply as a stranger, and it began to walk round and round him, sniffing in a curious way, as much as to say, "There's something about you that is not perfectly strange to me." The creature grew more and more excited, but when he stooped and patted it, and called it by its name, it gave what he described as a "scream of rapture," and jumped into his arms. From that moment it never left him. This is an instance of a dog nine years old remembering a person whom it had not seen for eight years.

2.

A GOOD JUDGE.—A cattle-dealer arrived in Paris with the intention of having his portrait painted. He applied to an artist, and in concluding the bargain dwelt strongly on his wish that the likeness should be striking and unmistakable. The painter promised that it should be so. "Indeed," he added, "I will appeal to the most disinterested judge possible—to your own bulldog; we will

show him the picture, and see whether he recognises you." Accordingly, when the picture was finished, it was brought into the dealer's lodging, placed on the floor, and the dog was called in. He instantly ran up to the portrait and began to lick it, wagging his tail, and showing every sign of delighted affection. The grateful dealer, convinced of the accuracy of the likeness, instantly paid down the sum demanded by the artist, quite unconscious of the fact that the picture had been well rubbed with a bit of bacon.

3.

CAUGHT!—A somewhat amusing incident is told of a woman whose husband, a wealthy man, died suddenly without making any will. The widow, desirous of securing the whole of the property, concealed her husband's death, and persuaded a poor shoemaker to take his place while a will could be made. Accordingly he was closely muffled in bed, as if very sick, and a lawyer was called in to write the will. The shoemaker, in a feeble voice, bequeathed half of the property to the widow. "What shall be done with the remainder?" asked the lawyer. "The remainder," replied he, "I give and bequeath to the poor little shoemaker across the street, who has always been a good neighbour and a deserving man," thus securing a good share for himself. The widow was thunderstruck with the man's audacious cunning, but did not dare to expose the fraud; and so the two rogues shared the estate.

4.

FINDING OUT A THIEF.—A gentleman in India missed a valuable ring, and had reason to think that one of his servants had stolen it, so he called all of them together, and holding a number of pieces of stick in his hand, made each servant draw one. He then ordered them to go away and come back to him in an hour's time, "when," said he, "the thief's stick will be found to be an inch longer than any of the rest." As a matter of fact the sticks were all of the same length. The man who had stolen the ring, not knowing this, cut an inch off his stick, in order to make it (as he supposed) of the same length as the rest. Consequently, when they again assembled at the end of the hour, his stick was an inch shorter than any of the rest, and in this way he was found out to be the thief.

5.

THE DOG AND THE POSTMAN.—There is a postman in one of the suburbs of London who has lately been put to serious inconvenience by the extraordinary conduct of a greyhound belonging to one of his neighbours. No sooner does he start on his rounds than the dog sets off also. When the postman drops a newspaper into the box the dog stops still, waits till the postman is a good distance off, then endeavours to force his way into the house. If the door is locked he follows his friend again, and waits his opportunity for making a second attempt. At length he succeeds. He seizes the paper in his mouth, and darts off at full speed. The postman has never been able to discover what he does with his stolen goods. He followed him once, but the dog was too quick in his movements to allow himself to be caught. This conduct is extremely awkward for the poor postman, who on more than one occasion has had to pay the cost of the paper to the angry subscribers.

6.

A UNIQUE WAGER.—An English gentleman, travelling in America, had his attention arrested by a singular contest between a negro and a mule on which he was mounted. The docile animal had thought proper to take exception to the carriage of a gentleman which preceded him, and evinced a decided disinclination to pass it. His rider, on the other hand, was as resolute in his determination that he should pass it. At length the gentleman heard blackey exclaim to the mule: "I'll bet you fivepence I'll make you go by this time!" Then, nodding his head, he added: "Do you bet?" After which, by using his whip and spur, he succeeded in making the animal pass the carriage. The gentleman, who had been highly amused with the scene, called to the negro, and observed that, though the wager had been laid he could not see how payment could be obtained from the mule. "Oh yes," replied the black. "Masser give me tenpence for corn for him; he lose the bet, and me only give him fivepence worth."

7.

AN AMUSING MISTAKE.—Considerable excitement was caused the other day at a railway station by the engine-driver of a passenger train, who told the station-master that a few minutes previously, when travelling at a high rate of speed, he had noticed standing on the railway embankment a man who, on the approach of the train, threw himself on the metals, and was run over by the engine and carriages. In an instant the officials were on the alert, and a telegram was forwarded to the police stationed at the nearest point, who in post haste started off, a distance of four miles, with the ambulance, having previously acquainted the nearest surgeon of the fact that his services were required. On the arrival of the police and the railway and medical authorities, however, their surprise and vexation may be imagined, for the object of their search was discovered to be simply a scarecrow, representing a man with an old black coat and a dilapidated silk hat, which had been blown from a field adjoining the railway on to the metals.

8.

THE WAY HE WAS FOUND OUT. Some years ago, in one of the cavalry barracks, a man complained that several articles of his had been stolen. The officer of the room, finding that the thief could not be discovered, got a large tin dish, and turned it upside down on the floor with the barrack-room cat underneath it. Then he ordered the gas to be turned down, and requested each man to touch the dish in turn, saying that the cat would mew when the thief touched it. As a matter of fact the cat did not mew; but the officer suddenly cried "I have him," and ordered the gas to be turned up. Then he ordered each man to show hands, and all were black except those of one man; for the officer had, unknown to the men, blackened the back of the dish before putting it on the ground. Needless to say that the one man who had not cared to tempt the trial by touch was the thief, and search among his things revealed the missing articles.

9.

A NOBLE REVENGE.—A farmer's horse happening to stray into the road, an ill-natured neighbour, instead of returning the animal to its master, put it into the pound (this is an enclosed place built especially for stray animals, and a fine has to be paid by their owner before they are liberated). Meeting the farmer, he told him what he had done, and added, "If I ever catch your horse in the road again, I will do just the same." "Neighbour," replied the farmer, "Not long ago I looked out of my window in the evening and saw your cows in my field of young clover. I drove them out and carefully shut them up in your yard. If I ever catch them again I will do just the same." Struck with this noble reply, the neighbour went to the pound, liberated the horse, and paid the fine himself.

10.

THE CAT AND THE PUPPIES.—The following story shows the strong affection exhibited by a cat for two puppies. She was mourning the loss of her kittens, when a little black spaniel with five puppies were added to the establishment. These were considered too many for her to nurse, and two of them were bestowed upon the disconsolate cat, who thereupon regained her cheerfulness and nursed them with motherly care. They became as active and playful as kittens, and in a short time, being considered fit to be removed, were restored to their natural parent. The cat, on this, wandered about apparently heart-broken, until, in the course of her melancholy perambulations, she encountered the spaniel surrounded by her happy family, and immediately recognised her foster children. A fierce combat ensued, resulting in the defeat of the spaniel and the departure of puss carrying off one of the puppies. Presently she returned, fought another battle, gained the victory and another puppy, and departed triumphant and contented.

11.

THE PUNISHMENT OF GREED.—A countryman presented Louis XVI. with a turnip of unusual size. The king, delighted with the simplicity of the man, commanded him to be presented with a thousand crowns, and the turnip (wrapped in silk) to be reserved among his treasures. A covetous courtier observing this, in hopes of a greater sum, bought a very handsome horse, and made a present of it to the king, who cheerfully accepted the gift, and gave orders that the turnip should be given to him, telling him at the same time that it cost a thousand crowns.

12.

AN INTELLIGENT COLLIE.—A farmer in the south of Scotland used to have a very clever and intelligent collie dog. On a fine morning it was regularly sent to take an old sow with her litter of young ones for a few hours' ramble in a neighbouring wood. The dog gently seized the mother pig's ear, and led her safely and quietly along, while her little ones trotted behind. When doggy thought it was time for them to go home again, he again seized the old sow's ear, and led her back to the farm. The pig never seemed at all frightened of the collie, but appeared to like its strange guardian's company.

13.

A CURE FOR LAMENESS.—A menagerie was erected in a field near a country town. Early next morning a report was spread that a young tiger had escaped from his cage. By the roadside was daily laid a man who had lost the use of his legs. For many years

he had lived upon pennies dropped by sympathising people who passed that way. Suddenly a great shout was heard in the distance. A crowd of terrified school-children, men, and women came rushing pell-mell down the road in the direction where the helpless cripple lay. As soon as they came near, crying out "The tiger, the tiger," the use of the cripple's legs seemed to be suddenly restored. Starting up like a deer, he threw away his stool, and darted off as fast as his legs could carry him. The tiger was soon captured, but the cripple was never again seen in that part of the district.

14.

LIGHT LOAF, LESS PAYMENT.—A boy bought a twopenny loaf at a baker's. It struck him that it was much smaller than usual, and he said to the baker, "I don't believe this loaf is the right weight." "Oh, never mind," answered the baker, "you'll have the less to carry." "Quite right," said the boy, and laid three half-pence on the counter. Just as he was leaving the shop, the baker called out to him, "Hi! you haven't given me the right money." "Oh, never mind," said the boy, "you'll have the less to count."

15.

CIRCUMSTANCES ALTER CASES.—A dog was standing by the cottage of a peasant. A person who dealt in dogs passed by that way. The dog said, "Will you buy me?" The man said, "Oh! you ugly little thing! I would not give a farthing for you!" Then the dog went to the palace of the king, and stood by the porch. The sentinel caressed it, and said, "You are a charming little creature!" Just then the dog-dealer came that way. The dog said, "Will you buy me?" "Oh!" said the man, "you guard the palace of the king, who must have paid a high price for you. I cannot afford to pay the amount, else I would willingly take you." "Ah," said the dog, "how place and position affect people!"

16.

AN EMPEROR'S THREAT.—A certain Emperor was going on a journey through his dominions when he came to a certain city, the gates of which were closed against him. He became very angry at this unexpected check, and while in his rage, he swore that he would not leave so much as a dog alive in that rebel city. His soldiers advanced to the assault in great glee, for they expected to get much plunder in the place. When the town was taken, the Emperor, who had meanwhile repented of his rash oath, said to the soldiers, "I have sworn not to leave a single dog alive in this city; take and kill all the dogs, therefore, if you wish, but I warn you not to touch or injure in any way a man, woman, or child, for I take them all under my own protection."

17.

COOLNESS.—In 1793, when Bonaparte was besieging Toulon, which was then in the possession of the English, he was one day directing the construction of a battery. The enemy perceived this, and opened a warm fire upon it. Bonaparte was anxious to send off a despatch, and asked for a sergeant who could write. One immediately stepped out of the ranks, and wrote a letter to his dictation. It was scarcely finished when a cannon-ball fell between Bonaparte and the soldier, and covered him with dust. The sergeant, looking towards the English lines, said, "Gentlemen, I am much obliged, I did not think you were so polite. I was just wanting a little sand for my letter." The expression and the coolness of the sergeant struck Napoleon, and he did not forget it. The sergeant was soon promoted, and later on became a noted general.

18.

THE BUTCHER OUTWITTED,—A butcher exhibited at his shop door some bullocks' tongues. Two thieves in search of their dinner noticed them at the butcher's door, and resolved to have them. Accordingly, one of the thieves made a rush into the shop, and, hastily addressing the butcher, said, "Did you not see a large black dog running away with a large tongue in its mouth?" "Impossible!" said the unsuspecting butcher, who fancied one of his tongues was stolen, and seizing a chopper, he rushed out of the shop after the supposed dog-thief, and, getting a glimpse of a dog somewhat answering the description given, he made full chase, but lost sight of the animal at the corner, where a crowd of hangers-on were loitering. The butcher asked if any of them had "seen a big black dog with a tongue in its mouth?" "With a tongue in its mouth!" said one of the crowd. "You stupid man! did you ever see a black dog without a tongue in its mouth?" "I am sold!" said the worthy butcher; and so he was, for when he returned to the shop he found that the whole of his tongues were gone, as well as the two thieves who had taken them.

19.

STORY OF A RAT.—A story is related of a rat that took care of its parent:—"Once in a vessel sailing from New York to Lisbon, the rats were found to increase very fast, and to be very mischievous. They ate and destroyed so much that the sailors grew quite angry, and resolved on the first opportunity to get rid of them. Accordingly, when the vessel was safe in Lisbon harbour, the captain ordered sulphur to be kindled in the hold. The rats, unable to endure the fumes, left their holes, and in endeavouring to escape were killed in great numbers. At length one appeared on the deck bearing on his back another rat which was quite gray with age and also blind. The men, supposing the old rat to be the father of the young one, were affected by the sight; they could not think of killing an animal which showed so much filial tenderness: it was therefore allowed to pass in safety, and to carry its aged parent to some other habitation."

20.

A NAME FOR TRAVELLERS.—An Englishman travelling on the continent had hired a smart servant, and on arriving at an inn in Austria one evening, knowing well the stringency of the police regulations, he called for the register of travellers that he might duly inscribe himself therein. His servant replied that he had anticipated his wishes, and had registered him in full form as an "English gentleman of independent property." "But how have you put down my name? I have not told it to you." "I can't exactly pronounce it, but I copied it faithfully from your portmanteau." "But it is not there. Bring me the book." What was his amazement at finding, instead of a very plain English name of two syllables, the following entry of himself:—"*Monsieur Warrantedsolidleather.*"

21.

AN ELEPHANT'S CUNNING.—An elephant was chained to a tree in the village. The driver made an oven at a short distance, in which he put his rice cakes to bake; then covered them with stones and grass and went away. When he was gone, the elephant with his trunk unfastened the chain round his foot, went to the oven and uncovered it, took out and ate the cakes, recovered the oven with the stones and grass as before, and went back to his place. He could not fasten the chain round his own foot, so he twisted it round and round it, in order to look the same, and when the driver returned the elephant was standing with his back to the oven. The driver went to his cakes, discovered the theft, and looking round, caught the elephant's eye as he looked back over his shoulder out of the corner of it. Instantly he detected the culprit, and punishment followed.

22.

A BANK-NOTE WITH A STORY.—Not long ago a well-known collector of curiosities became the possessor of a Bank of England five-pound note to which an unusually strange story was attached. This note was paid into a Liverpool merchant's office in the ordinary way of business, and the cashier of the firm, while holding it up to the light to test its genuineness, noticed some faint red marks upon it, which, on closer examination, proved to be words, scrawled in blood between the printed lines and upon the blank margin of the note. Extraordinary pains were taken to decipher these characters, and eventually the following sentence was made out:—"If this note should fall into the hands of John Dean, of Carlisle, he will learn hereby that his brother is a prisoner in Algiers." Mr. Dean was promptly communicated with, and he appealed to the Government of the day for assistance in his endeavour to obtain his brother's release from captivity. The prisoner, who had traced the above sentence upon the note with a splinter of wood dipped in his own blood, had been a slave for eleven years. His family had long believed him dead. Eventually his brother, with the aid of the British authorities, succeeded in ransoming him, and brought him home to England, where, however, he did not long survive, his constitution having been injured by exposure, and labour in the galleys.

23.

A REMARKABLE DUEL.—An English bull dog in France, returning one day without his master, induced the people to follow him to a certain tree in the forest; here the dog began to scratch, and, on the ground being dug, his murdered master was found. The dog, although gentle to all others, was suddenly seized with great frenzy whenever he saw a certain gentleman, who had once been his master's rival, and people began to suspect him as the murderer. The King of France, hearing of these remarkable circumstances, decided that the case should be settled by the chance of battle: that the dog should fight the gentleman, and thus decide his guilt or innocence. The man had a stout cudgel for his weapon, and the dog had an empty barrel, into which he might retreat when out of breath. The dog rushed fiercely out, and dodging about to avoid the cudgel, menaced the man on every side. His strength was taxed to the utmost, and was failing rapidly, when the dog suddenly sprang upon him, and gripped him by the throat; he then confessed his guilt in the presence of the king, and the assembled spectators. A few days after he was beheaded.

NEW READING TESTS.—STANDARD III.

Suitable for "Unseen Tests" in Dictation also.

43.—In some of the South Sea Islands sharks come so regularly to get food of one kind or another that they grow quite tame. At one time, before the missionaries had taught them better, the natives looked upon this fish as a kind of messenger or servant of the gods. In one of the islands a temple was built for a shark which was fed by the priests.

44.—Some time ago while an old Hungarian peasant and his daughter were driving pigs to market, a wolf leaped out of some bushes by the roadside and attacked one of the animals. The girl, thinking it was a dog, began beating it with a stick, whereupon the wolf turned on her. With a blow of a cudgel, however, her father stunned the creature.

45.—She was very quick and ingenious at all sorts of fancy and art needlework, and had influence enough to obtain plenty of employment in this way, and fair payment for her work. So she took her present humble and rather dingy rooms, and faced her changed circumstances fearlessly, though not without a sigh of regret for the past.—(H.M.I's TEST.)

46.—A small boy entered a butcher's shop, and in a business-like manner, as though impressed with the importance of his errand, asked for three pounds of mutton. "Yes, my little man of business," said the kind-hearted butcher. "And what part does your mother want?" "I don't know what part," replied the child, "but mother is going to make beef tea with it."

47.—An invalid lady once had a pet frog, which was so tame he would hop about on her hand and croak as long as she held him. When she wished him to sing, no matter what the hour might be, all she had to do was to give a little croak. One day she wanted to paint a side view of the animal, but do what she could the creature always hopped round so as to face her.

48.—A mother gave her little boy two bright new pennies, and asked him what he was going to do with them. After a moment's thought the child replied: "I am going to give one to the missionaries, and with the other I am going to buy a stick of candy." After a while he returned from his play and told his mother that he had lost one of the pennies. "Which did you lose?" she asked. "I lost the missionary penny," he promptly replied.

49. THE paths are green along the cliff,
And fresh the breezes blow;
The yellow broom is all a-bloom,
And the blue sea laughs below.
The brooklets sing for summer come
All through the golden morn;
And hark, oh, hark, how the dear lark
Springs singing from the corn!

NEW DICTATION TESTS.—STANDARD IV.

Suitable for "Unseen Tests" in Reading also.

No. 247.

One must go to school, or give himself deeply to study, in order to get knowledge; but one may be wise without knowing how to read or write. The man who should possess both knowledge and wisdom, being able to sustain what he knows, on the one hand, and to draw the line exactly where his real knowledge leaves off, on the other, would be the greatest philosopher that the world had ever seen.

No. 248.

There are few districts in the world that are positively rainless, but the whole coast of Peru is one. It is mostly a barren sandy desert, varying in width from 30 to 60 miles. Fortunately it is broken by numerous valleys of great fertility watered by streams that rise in the mountains, and these rivers enable cultivation to be carried on. Rain is unknown, for the reason that the coast line is within the region of the perpetual south-east trade winds. These winds, laden with moisture from the Atlantic, strike the east coast of South America and discharge their rains.

No. 249.

A carpenter's right shoulder is almost invariably higher than his left, in consequence of having to use his right arm all the time in planing and hammering. With every shaving his shoulder rises with a jerk, and it finally becomes natural to him to hold himself in that way. The head of a bricklayer's labourer is held aloft with a haughty, self-reliant air, from his habit of carrying a hod on his shoulder and looking above him as he climbs up the scaffolding.

No. 250.

It has long been known that the stalk of the sugar-cane might be used in the production of a paper of the best quality. It is, therefore surprising that with the constant decline in the value of sugar, owing to over-production, and the steadily increasing use of paper, it has never occurred to sugar planters to embark in the manufacture of paper as a supplement to sugar-producing. The fibres of the cane give an excellent paper, and the necessary mechanical and chemical processes are easily carried out.

No. 251.

Nothing so helps the unfortunate to bear their burdens as a belief that those burdens are a part of the providence of the world, and come to them with purpose and design, and, although not easy to bear now, have a future benefit, not only to themselves, but to the whole universe at large. This belief begets a spirit of humility which in itself gives the strength to bear more than half of the hard load.

No. 252.

Of all the precautions taken against the spread of influenza, none are more thoroughly good in intention than those which have been adopted at Dover. The authorities there have posted up notices to the effect that a penalty of £5 will be inflicted upon persons exposing themselves in public places when suffering from the malady. But it is disputed whether the malady is contagious, though that it is so has become the general belief.

No. 253.

Very many flowers, like the violet, yield their delightful odours through life, day and night; others, like the night-smelling stock, exhale their scent only in the evening, and while darkness continues; others again, like the hyacinth, while perceptibly fragrant during the day, give out a far stronger perfume by night. Some flowers only exhale their fragrance early during flowering, while in other classes it is given forth only at particular periods.

No. 254.

Every man has at times in his mind the ideal of what he should be, but is not. This ideal may be high and complete, or it may be quite low and insufficient; yet, in all men that really seek to improve, it is better than the actual character. Perhaps no one is so satisfied with himself that he never wishes to be wiser, better, and more holy. Man never falls so low that he can see nothing higher than himself.

No. 255.

A curious fact has been told in relation to the young ants. They are not only nursed well and tended in their helpless state, but, when freed from the shell, they are trained for their coming duties. The young ants are taken through the ant-hill dwelling. The roads in and out are explored, the galleries and the cells are shown, and the ways of coming to, and leaving them, are learnt. As the day wanes they are carried into their own cells.

No. 256.

Eyes which are large, open, and very transparent, and which sparkle with a rapid motion under well-defined eyelids, denote elegance in taste, and somewhat susceptible temper. Eyes with weakly marked eyebrows above them, and with thinly growing eyelashes, which are complete without any upward curve, denote a feeble constitution and a melancholy disposition.

No. 257.

A correspondent says that an unusually large number of vipers infest his neighbourhood, and that several of these dangerous reptiles have been killed quite recently. No less than ten vipers have been killed, and the cottagers who live in the neighbourhood eagerly seek after them when dead, extracting from them oil, which they declare to be a sure antidote to a bite from a viper.—(H. M. I.'s TEST.)

No. 258.

Every man has two educations—that which is given to him, and the other which he gives to himself. Of the two kinds, the latter is by far the more valuable. Indeed, all that is most worthy in a man he must work out and conquer for himself. It is that which constitutes our real and best nourishment. What we are merely taught seldom nourishes the mind like that which we teach ourselves.

No. 259.

One of the greatest initial difficulties in the making of the steel pen, as we of the present day familiarly know it, was the forming of the centre slit. At first a slight cut was made at the extreme point by a sharp chisel with a light hammer. The nib was then subjected to a succession of light, sharp blows, by which a crack was developed—not necessarily in the direct line of the pen's length—and the two sections parted.

No. 260.

There seems to be but three ways for a nation to acquire wealth: the first is by war, as the Romans did, in plundering their conquering neighbours—this is robbery; the second by commerce, which is generally cheating; the third by agriculture, the only honest way, wherein man receives a real increase of the seed thrown into the ground, in a kind of continual miracle, wrought by the hand of God in his favour, as a reward for his innocent life and his virtuous industry.

No. 261.

The comparative success of the existing electric railway in London has evidently given an impetus to the movement for providing still further means of locomotion of a similar kind. For consideration during the forthcoming session of Parliament there are no fewer than five Bills which propose either the construction of new electric railways or the extension of lines already authorised.

No. 262.

The pay of the police force is very liberal, but not in excess when the onerous and responsible duties which its members have to perform are taken into consideration. After serving twenty-one years any member of the force can resign and claim a very handsome pension. If he should be obliged to retire earlier, either through failing health or from injury received in the execution of his duty, he is the recipient of a generous compensation.

No. 263.

Heaven is not reached at a single bound;
But we build the ladder by which we rise
From the lowly earth to the vaulted skies,
And we mount to its summit round by round.

I count this thing to be grandly true:
That a noble deed is a step toward God,
Lifting the soul from the common clod
To a purer air and a broader view.

STANDARDS V.—VII.

No. 227.

The welcome news has at length arrived that the *Victoria* battleship is once more afloat, after lying for nearly a week on the rocks. It is well that the huge ironclad met her mishap in calm and almost tideless waters. Had she been stranded on a rugged reef, and exposed to stormy seas, a very different story might have to be told. While the tides rendered very little help in floating the *Victoria*, their slight variation saved the great ship from perilous strains. The smooth surface of the rock was an immense advantage, and, if a vessel was to be run ashore at all, a better place could scarcely have been found. But still the question remains why the *Victoria* was ever placed in such peril.—(H. M. I.'s TEST.)

No. 228.

There may be certain reasons for exercising torpedoes in shallow waters, but there are still stronger reasons why huge ships, drawing twenty-seven feet of water, should have depth enough to swim in. The *Sultan* was stranded on an unknown rock, and it is implied that the *Victoria* was similarly entrapped. The curious explanation is offered that many rocks on the Greek coast are not shown on the charts carried by British men-of-war, as these big ships are not expected to go where the rocks lie. If this be so, our first-class battle-ships, and others as well, had better give the Greek coast a wide berth. Through some misapprehension in regard to this matter, the nation has nearly lost a costly ironclad, or at best there has been the risk of serious damage.

No. 229.

In summer our dwellings ventilate themselves, with little care on our part; but in winter we economise heat at the expense of ventilation. Few houses are provided with artificial ventilators, while the drainage is generally far from perfect. Even houses supposed to be above suspicion in this respect are often found to be dangerously defective. The main sewer is seldom or never free from disease, and these may find entrance into our rooms through untrapped or imperfectly trapped connecting pipes.

No. 230.

We make large claims upon the poet who, in the highest sense of the word, deserves that title. He is something better than the idle singer of an idle lay, who relies solely on the music of his song. Harmony there will be, for that is essential to noble verse; and imagination, for that is a poet's highest gift; and elevation of thought, since the poet, when his singing-robes are on, is lifted above his fellows, and these different faculties must be so blended as to exercise a moral influence, not because the poet is a didactic teacher, but because in his inspired moments he has a clearer and more expansive vision of life. And the intense emotion that prompts his verse will quicken a like feeling in his readers, so that for a little while they see with his eyes and feel with his heart.—(H. M. I.'s TEST.)

No. 231.

For some time past transparent glass bricks have been let into walls to afford light at places where a window would interfere with the architectural plan. But now it is proposed to cast glass, not necessarily transparent, into large blocks for buildings. This material is practically indestructible, perfectly non-absorbent, and therefore damp-proof, in a manner which few bricks are, and in this way coarse glass of this kind could be made nearly as cheap as concrete, stone, or baked clay. A plan has also been put into

practice by which broken glass of various colours is mixed up, placed in moulds lined with some resisting material, and fired.

No. 232.

The Postmaster-General presided at the second annual meeting of the Postal and Telegraph Christian Association, held last evening in the Post Office Institute, Edgware Road. The right hon. gentleman remarked that in the large army connected with the Post Office there were many young soldiers on whose good conduct at this time of their lives depended greatly their future prosperity. He took special interest in any institution intended to give a helping hand to the young. He hoped that there were in London a great many people who took an interest in the younger members of the post service. To the ladies and gentlemen who came forward voluntarily to do this work, he was there to testify his great respect.—(H. M. I.'s TEST).

No. 233.

The healthy emulation which a good teacher inspires, the prompt obedience and regular movements required in simultaneous exercises, and the thorough daily routine gone through, in accordance with the requirements of the Educational Code, are all advantages which can hardly be obtained in home education. The striving after a high position in the class, their triumphs, aye, and their disappointments, must help to form grand characters, and to give the children a forecast, in their miniature world, of what awaits them when they shall have left their happy school days behind.

No. 234.

Winter is the season of balls and dancing parties, and, in general, of prolonged amusements and excitements. We need not say how common it is for young ladies to attend such gatherings imperfectly clad. The excitement, physical and mental, extending to a late hour of the night, renders the surface of the body peculiarly susceptible to the outside chill; the susceptibility is enhanced by the exhaustion, which at the same time lessens the power of resistance. The danger is especially great in country districts. Tens of thousands have in this way laid the foundation of fatal disease.

No. 235.

What the servants of the present time want most is a regular training in domestic duties. This they find it difficult to obtain. Shop girls, on the other hand, by giving their first months of service without payment, receive the training they require. Dressmakers are regularly apprenticed to their trade, but cooks and nurses are apparently "born," like poets, not made. Cooking is quite as difficult, in its way, as dressmaking. Why should not equal pains be taken to master its intricacies? Nursery work is important enough to the little lives entrusted to the care of the nurses, but young girls drift aimlessly into it without feeling any love of children, or being aware of any special aptitude for the task of caring for them.

No. 236.

Coal-miners are subject to an affection of the eyes, produced either by the insufficient light they work in, or, what is more likely, the position they work in. Another class of toilers who pay a heavy toll in sickness and death are those who follow the employments of knife-grinding, pill-making, and needle and pin-making. The dust they inhale is particularly irritating to the lungs and bronchial tubes, and produces various forms of incurable and fatal lung complaints, but wet grinding, ventilated wheel-boxes, and the wearing of respirators have done much to obviate the unhealthiness of these employments.

No. 237.

When, in the midst of life's hurry and worry, we meet a smiling face, it seems a prefect God-send, and we sometimes think, when seeing how much woe and suffering there is in the world, that if we would each of us smile more, life would be so much easier to live for all of us; for a sunny face sweetens both outside and in; both the owner and the beholder. The trouble with us is, that when we take the pains to smile, we feel, as a general thing, that we are doing it solely for somebody else's benefit, while, if we did but know it, it is "life and health and peace" to ourselves in many ways.

No. 238.

The registry office system is an unsatisfactory one. At most of these offices the servant pays nothing until suited with a place. The mistress, on the other hand, is not allowed to have her name or needs entered in the books until she has paid a preliminary fee. This in no way secures the introduction to her of a single candidate for employment. Weeks may pass by before a servant is secured, and sometimes the office may totally fail to supply the cook or housemaid wanted. In this case, it might be supposed that the preliminary fee would be returned, less any expenses of correspondence or otherwise that had been incurred. But the fee is never returned under any circumstances.

No. 239.

We never know whether a thing which happens to us is a piece of good or ill fortune until its results have been worked out. The most promising enterprises are proverbially those which often mean both fame and fortune. The thing that was certain before we undertook it vanishes in thin air; the thing which seemed the most uncertain becomes solid fact under our feet. We ought not to account ourselves fortunate until we are sure that the things which seem to us specially prosperous have demonstrated their permanency, and we ought not to account ourselves unfortunate until the things that seem to us misfortunes have borne their real fruit.

No. 240.

No human being can come into this world without increasing or diminishing the sum total of human happiness, not only of the present, but of every subsequent age of humanity. No one can detach himself from this connection. There is no sequestered spot in the universe, no dark niche to which he can retreat from his relations to others, where he can withdraw the influence of his existence upon the moral destiny of the world; everywhere his presence or absence will be felt—everywhere he will have companions who will be better or worse for his influence. It is an old saying, and one of fearful and fathomless import, that we are forming characters for eternity.—(H. M. I.'s TEST).

No. 241.

More and more as we grow we appreciate the finer traits that are in human nature. Men going out into life never forget the mother who stays at home, and who has presented to them a nature with reason dominant, with a high moral sense, with refined and sweet affections, with haste, with patience, with gentleness, with self-sacrifice, and with disinterestedness. A man may go through all the world, he may run through every stage of belief and unbelief, he may destroy his fineness in every respect, but there will be one picture that he cannot efface. Living or dying, there will rise before him, like a morning star, the beauty of that remembered goodness which he called "mother."

No. 242.

Women of the well-to-do classes have undergone considerable training in domestic duties since the time when cookery classes came into fashion. They are theoretically capable, and no one can tell how soon they will be required to put into practice the various domestic accomplishments they have acquired. Some prophets declare that in twenty years there will be only enough servants left in England to supply the wealthiest homes. Should that day ever come, it will be the signal for a domestic revolution, in the course of which more than one difficult problem will find solution.

No. 243.

The quality of mercy is not strain'd;
It droppeth as the gentle rain from heaven
Upon the place beneath. It is twice blessed;
It blesseth him that gives and him that takes.
'Tis mightiest in the mightiest; it becomes
The throned monarch better than his crown:
His sceptre shows the force of temporal power,
The attribute to awe and majesty.
Wherein doth sit the fear and dread of kings.
But mercy is above this sceptred sway:
It is enthroned in the hearts of kings,
It is an attribute to God himself;
And earthly power doth then show likest God's
When mercy seasons justice.

IN THE BABIES' ROOM: WHAT TO DO, AND HOW TO DO IT.

BY MISS J. W. WARREN,
Inspectress of Infant Schools, Leicester School Board.

THE subject of my paper this month may strike some of my readers as being rather devoid of precedent, but not so when they consult homes of intelligence and learning. It has been my lot more than once to call in the house of a learned professor and find him blowing bubbles with his three-year-old boy; and any remonstrance, or imaginary remon-

strance, on my part would invariably bring forth a perfect torrent of scorn from the said learned man on the want of insight shown by the anti-bubble-blowers in the perfect instruction of babies.

As one of your regular plays, teacher, let me introduce to your notice "Soap Bubbles." This real, wholesome, delightful fun might be relied upon to give interest if you made it a bi-monthly treat. All these plays might be taken more frequently; but, when a suggestion as to time is given, it may be safely inferred that it is for some good reason, and so accepted without further comment.

How to make the Suds.—Do not rely upon the old and original plan of dirty soapsuds; these, of course, are highly injurious both to the delicate membranes of nostrils and lips. No; if you are to use this simple amusement in your babies' room, the materials must be prepared decently, and with great care and cleanliness. Use plain yellow soap. Cut a cake about the size of a fig into fine shreds; pour over it a pint of very hot water; stir it up constantly; and, after letting it stand for intervals of five minutes, stir it again until the soap has dissolved and the water has become gummy. It will be necessary at this stage to whisk up the mixture and blow down into it air through a pipe-stem or a boy's pea-shooter, or, better still, a glass tube, which last can be borrowed from the laboratory in the boys' department of your school.

To prepare the Pipes.—Get the man who cleans the school to buy these—a man buys pipes much cheaper than a woman. The pipe is the ordinary clay known as the "churchwarden"; for sixpence enough can be bought to supply all the babies, and it is essential that all should be allowed to have them.

The pipe will be too long when bought, but shorter must not be got even though cheaper; it can be broken to length required, and the mouth-piece made clean and nice by applying sealing-wax. I have found that a measurement from bowl to mouth-piece of ten inches is very satisfactory; and, by breaking off the slender top of the "churchwarden," I gained the larger aperture for blowing. Shorter pipes do not allow of this; and, even if they did, it will be well to have the stem as long as is compatible with easy blowing.

Plan of Work.—When you have made your suds, put them in a clean basin; stand it in your class-room on the table; arrange your little ones in a circle round it, and, taking the pipes in one hand, just dip the open bowls slightly into the mixture. You can in this way charge about six at a time, and can set off about eighteen at once. When given to the children they must hold them downwards, or just the opposite way to the ordinary smoker, else the suds' weight will break the embryo bubble. When you have charged about eighteen thus, give the order to blow gently, and then the word "off," to indicate the forming of the bubble. The babies will learn by nature to blow and shake off gently, and will easily adjust themselves to the amount of atmospheric movement. When blown off the bubble can be kept in movement by continued blowing. This play should now be repeated with those whose turn didn't come at first, and later on the children may be called up to dip each his own pipe into the suds. Now, however, it will be necessary to guard against the children's filling their pipes and turning them up cup-wise. As is well known, this plan would result in a very pretty display of small, partly-formed, connected bubbles, but must be studiously avoided, as the children are so apt to draw the soapsuds up into their mouths.

Those teachers who are so fortunate as to have a young candidate to help, may do much more with this very interesting occupation than they could do alone. It needs continual care to prevent its degenerating into a mess that would neither elevate nor interest even a baby.

Seeking for the utility of this occupation, one is tempted to fall back on its very evident origin as an elucidation, and to say that what the child finds out for himself has surely some interest in it educationally. Somewhere Ibsen makes one of his characters (I believe it is Hilda) say of castles in the air: "They are so easy to build," and so "nice to live in." Something of this spirit lives in the bubble-blower's fancy—that subtle delight that is all the more real because it cannot be expressed. It appeals to the emotions, and to the sense of beauty that, in very young children, is fresh and keen, and yet by its means these are enabled to embody, or rather enclose, the caught air. More I need not say. When you see the wrapt, eager gaze of the sweet upturned faces, the spasmodic yet graceful little flight-like attempts to catch again the beautiful coloured ball but lately raised by such simple means from such humble origin, you will know that the deep truths underlying such work are at least felt, and will retain for ever their place in any rational system of education.

I do not attempt to explain the scientific side of this play. That belongs to the school, and should find no place whatever with us, though it has its place, undoubtedly. But I cannot refrain from pointing out that "Bubbles" is a most excellent means of directing the pupils' eyes and arms to move in concert. In Froebel's "Education of Man," he protests vigorously against aimless movements in very young children, and, amongst other things, gives flights of birds and flashes of light as means for us to found movements upon such as those referred to above. In some continental schools paintings on the ceiling are placed for the purpose of direct reference to strengthen the muscles of the eyes.

The domestic scene that gave rise to this baby-play can be imagined. The cottage home on a washing-day, the busy mother at her wooden tub, the babies of various ages clinging round, poking their fingers into the warm, pretty froth, and breaking up with a touch the rosy bladders that formed again even with the rough, hard work of mother's dear busy hands; and it needs but a step in the region of imagination to bring the father on the scene with his pipe, and his little bit more brain, and the bubble gets its birth. Any way, dear readers, you and I may cling to this, making for ourselves a legend, for it is such lore as we are allowed to use for our purpose, and very refreshing it is.

If this play is taken up in other classes, it should of course include a little of the science of colours, being as it is one of the most perfect means of demonstrating this interesting subject. A previous use in the babies' room will have paved the way, and more careful instruction will easily follow on.

Caution.—Do not use your emulsion in a tin bowl, and do not, on any pretext, make it with common soap.

VITAL STATISTICS.

BY WALKER OVEREND, B.SC. (LOND.), B.A. (OXON).

Late Scholar of Balliol College, and Radcliffe Travelling Fellow; Deputy Lecturer on Physiology at St. George's Hospital, London, W.

30. *Disinfectants. Isolation. Disinfection.*—A true disinfectant is a germicide, that is, it destroys and so prevents the growth of micro-organisms. To grow and multiply, these organisms require moisture, and certain substances in solution as food. To determine whether an agent is a disinfectant, the bacillus (whichever we select, say the bacillus of anthrax) is placed in a solution of the substance of a certain strength for a definite time, say five minutes, ten minutes, or longer; then the bacillus is removed into a nourishing medium. If the organism refuses to grow, the inference is that the substance is a true disinfectant. The chief disinfectants are carbolic acid (phenol), corrosive sublimate ($HgCl_2$), chlorine gas, sulphurous acid fumes (SO_2), and heat.

A 1 per cent. solution of carbolic acid will kill the rods of *bacillus anthracis* (the microbe of anthrax) in one minute. A 5 per cent. solution destroys the tubercle bacillus within 24 hours. To make quite certain that any virus is rendered harmless, the strength of the carbolic acid should be 5 per cent. and the time prolonged. Corrosive sublimate is also a powerful germicide. One part in 1,000 destroys the bacilli of tubercle in eight hours; and a 1 per cent. solution destroys the *spores* of anthrax. Chlorine evolved in the air of rooms, by adding sulphuric acid to bleaching powder, is an effective disinfectant, if care be taken to render the air moist previously. It is superior to SO_2. Many of the so-called disinfectants are worse than useless, since they may give rise to a false sense of security. Some simply conceal offensive odours. Sanitas (terebene) has certainly some oxidising properties. Condy's fluid is a powerful oxidising agent, but has little power as a germicide. Salufer (a double fluoride of silicon and sodium) has some claims to usefulness.

31. *Heat* is most powerful. The spores of anthrax lose their vitality after one hour's exposure to a dry heat of 245° Fahrenheit, and they are killed in one minute by boiling. Steam at 212° Fahrenheit destroys all contagia. Steam can penetrate substances better than hot air by virtue of its latent heat. When it penetrates it condenses, and more steam then passes forward. In Lyon's apparatus this power is aided by pressure. The latter consists of an iron chamber with double walls and tightly fitting doors. Steam from a boiler can either enter the space between the two walls, or the interior of the chamber. The articles, bedding, &c. which require disinfection are placed in the chamber, and the doors closed; the steam is then introduced into the outer casing first, and then into the interior. Bradford's and the Nottingham disinfecting apparatus are methods of disinfection by means of hot air.

32. *Isolation and Disinfection.*—In practice we have to deal with two sets of conditions, one when the sick person is alive, and the other when death or recovery has occurred. In the former, the patient should be isolated in a hospital for infectious diseases, or, if too ill for removal outside, should be placed in a room on the top storey where a fire is kept burning, the window opened as much as is practicable, and the door kept closed. In this way the contagium thrown out by the patient is at once diluted by the atmosphere. The nurses—there should be two—should not be permitted to mix with the family. On leaving the patient's room the nurse should take off her dress and put on another kept in an adjoining apartment, which is thoroughly ventilated. All crockery, &c. used by the patient should be kept entirely separate, and all unnecessary furniture should be removed from the room, as hangings, curtains, carpets. A straw mattress and flock bed should be used.

In scarlet fever, diphtheria, typhoid, typhus, and cholera, all soiled linen, bedding, and excreta should be disinfected, the linen steeped in dilute carbolic, or corrosive sublimate; the excreta and soiled linen may be placed in a solution of green vitriol ($FeSO_4$), 1 ounce to the pint of water, or more preferably in a 2 per cent. solution of corrosive sublimate, and the stools poured down the closet, which is then flushed with a saturated solution of carbolic acid. For discharges from the nose, pieces of soft rag must be used and burnt.

To disinfect the room at the end of the illness, the window, chimney, and crevices are pasted up with brown paper; the floors and walls saturated with water; cupboards and drawers opened wide. Bleaching powder, 1 lb. for every 1,000 cubic feet of space, is placed in the centre of the room, and a sufficient quantity of sulphuric acid added. The keyhole is then pasted up, and the room is left closed for 24 hours. At the end of this time the doors are opened, ceilings washed, the walls stripped, and the floor scrubbed. All things that can be washed are removed, but pillows and bedding are conveyed to the steam chamber of Lyon's apparatus.

33. *Influence of Soils on Health. Ground Air. Ground Water.*—Soils are divided into two classes, (*a*) pervious, (*b*) impervious. The latter are solid, dense, and contain little air, as granite, hard limestone, and dense clay. The pervious soils are such as chalk, sand, sandstone, and vegetable soils. The division is one of fundamental importance to the sanitarian. *Artificial* or *made* soils are such as the ground made by filling up large excavations with rubbish and refuse of all kinds. The rain water soaks into the pervious soils until it reaches a denser layer. There is therefore beneath all gravels and chalk a sheet of water, which is called *ground* or *subsoil water*. This water may be only a few feet from the surface, or it may be hundreds of feet. Its amount will depend *cisteris paribus*, on the ease or difficulty of outflow, for it is in constant movement, tending to the nearest water-courses. Its level is also constantly changing, in correspondence with the amount of rainfall, or with increased difficulty to the outflow, or *vice versâ*. London, for the most part, lies upon a bed of gravel 10—20 feet deep, overlying strata of impervious clay.

Ground water contains gases in solution, oxygen, nitrogen, and carbon droxide. These are derived from the *ground air*. The air contained in soils, or ground air, is rich in carbon droxide, sometimes as much as 25 per cent. The latter is derived from the organic matter by the agency of bacteria. The ground air is also in continual movement. The fall of rain, for instance, raises the level of the ground water, and displaces ground air into higher strata, or forces it into the atmosphere; changes in barometric pressure, and variations in the ground temperature, also determine its movement. Moreover, local conditions may influence it; a warm house will draw in air from the ground below, and, to prevent this, the basement should be paved and concreted, since the air of cesspools or of broken drains may otherwise enter the house. In the cellars of many houses unpleasant effluvia are noticeable, and are often due to the entrance of ground air. For this reason, houses built on made soils are unhealthy.

34. *Surface* wells are drawn from the ground water, and if this be polluted, the well is a danger to health. *Deep* wells are those sunk through the ground water, through an impervious stratum, into a deeper stratum bearing water. Such water is exceedingly pure. Artesian wells are also deep wells, but so arranged that the ground water on higher lands around is high, and the water from the deep well, in seeking to find its level, overflows at the surface, no pump being required.

Soils containing much water are unhealthy, inasmuch as they produce colds, rheumatism, and neuralgia. Moreover, in damp soils, bacteria find a suitable nidus. De Haviland has shown that certain diseases in England are more prevalent in certain areas. For instance, cancer does not appear to thrive on hard, dry soils. Damp clay soils, and elevated parts exposed to westerly or N.W. winds, have a high mortality from phthisis; and the draining of the soil, by lowering the level of the ground water, in many towns has diminished the death-rate from this disease.

35. Baldwin Latham has pointed out that a dry winter is often the forerunner of disease, not in the next spring, but in the following autumn. A short supply of rain in December has a most marked influence on the ground water. There is a connection between the health of a population and the volume of ground water. The years with a large quantity of ground water are the healthiest. Lowering of the subsoil water by artificial means has favoured the spread of typhoid fever. The death-rate is lowest following a wet season, and highest after a dry one.

Pettenkofer also connected typhoid fever with a falling level of the subsoil water, Ballard has also shown that habitual moisture of the soil (not sufficient, however, to exclude air *in toto*), such as is produced by a high level of the subsoil water, is exactly the condition which a contaminated soil requires, at a certain temperature, to favour the growth of the organism of summer diarrhœa. (See paragraph 22, "Vital Statistics," February number). Diphtheria is thought by some to be related to a somewhat similar condition. The diphtheria bacillus appears to grow luxuriantly in that amount of moisture existing just above the level of the ground water, and its displacement into the atmosphere might be effected by a sudden rise in the ground water. Sudden alterations in the volume of the ground water may thus possibly play an important part in the dissemination of certain of the zymotic diseases by flooding the air with noxious germs.

36. *Diphtheria* causes about 3,500 deaths annually in England and Wales, and 50 per cent. of the deaths are between the ages of one and five.

Symptoms.—After an incubation period, varying from two to five days, the disease begins with loss of appetite, headache, sickness, and general lassitude. Soon the little patient complains of stiffness in the neck and sore throat. The fever becomes high, and on the back of the throat greyish-white patches of fur become visible. The countenance is exceedingly pale, and the patient excessively weak. The patches on the throat may spread upwards into the nose, or

downwards into the larynx and windpipe, interfering with respiration. Death may occur within 36 hours from suffocation, or, later on, from failure of the heart or general exhaustion. Subsequently the lymphatic glands in the neck may inflame, and discharges from the ears may commence. For a time there is great weakness of the legs, and there may be some difficulty in swallowing.

Distribution.—In England, the counties of Devonshire and Cornwall are singularly free from diphtheria, while it is very common in the eastern counties and in Wales. Density of population does not appear to favour its occurrence. France and Minnesota are its headquarters abroad.

Nature of the Poison.—A specific germ or bacillus has been isolated, which lives in the patch on the throat. As a result of its growth, in that situation, it produces a certain ferment, which, when absorbed into the system, acts upon the proteids and converts them into bodies, called albumoses. These produce the fever, and the intense depression of the vital powers.

Dissemination.—Authorities are not agreed, and extended knowledge is imperatively needed. Some point out that the curve of diphtheria mortality resembles that of typhoid, and that the largest number of cases occur in the same district. They infer that these two bacilli find in excretory refuse a favourable site for development. Others have referred to polluted subsoil as favourable situations for its growth, and have connected it with a sudden rise of the ground water. Some authorities think its dissemination is caused by means of mild cases (not seen by medical men, and therefore not notified), acting through the agency of schools. We are certain, however, that it may be transmitted from animals to man. In some instances it has been attributed to the use of milk. Power pointed out that there is a slight affection of the udder, consisting in the eruption of vesicles, in newly-calved milch cows, and that this is transmissible to other cows. Moreover, in such cases, the bacillus of the diphtheria of human subjects exists in the milk.

Prevention.—1. Actual contact with diphtheritic patients is dangerous. Such should be isolated, and those in attendance should use a gargle of dilute carbolic acid several times daily. The back of the throat is the vulnerable spot, and the disease is purely local at first.

2. All milk should be boiled. There should be an extension of the present law, to permit sanitary officers to deal with the disease in the cow, and forbid the sale of milk.

3. All rags infected with secretion should be burnt, and thorough disinfection subsequently carried out (par. 32).

4. Diphtheria occasionally prevails in schools. The sanitary state of the school, and of the homes of the children suffering from it, should be inspected. Plentiful gatherings of children are certainly a factor in its dissemination, since they are its chief victims. In some cases the schools and playgrounds must be closed.

37. *Scarlet Fever.*—Seventy per cent. of the deaths from scarlet fever (about 18,000 annually) are in children under five. After an incubation period of between two and five days, the child shivers, complains of headache, or passes into convulsions. Soon there is a sore throat, and great thirst. On the second day a rash of red spots appears and spreads rapidly. The rash is first visible on the upper part of the chest, and the face and forehead soon become flushed and very red. The rash commences to fade after about four days, and as it disappears the skin peels off in patches or in fine scales. During the height of the attack the fever may be very high (104° or 105° Fahrenheit), and death may occur on the fifth day, from sheer exhaustion of the vital powers. Two or three weeks after the beginning of the illness, if the child catches a chill before the peeling is finished, the ankles become swollen and the face puffy. This is due to inflammation of the kidneys. Subsequently there may be left a discharge from the ear, with deafness, or the glands in the neck may become enlarged and inflamed.

Dissemination.—Actual contact is a most effectual means of contracting the disease. Sometimes an outbreak has been traced to a particular milk-supply, and, at the same time, no cases of the disease were to be found among the children belonging to the dairy. This suggests the view that the milk has become infected by some morbid condition of the cow itself. In one instance, at Clapton, the dairy itself was scrupulously clean, but some of the cows were ailing, their temperature was higher than normal, and cracks and abrasions were to be seen on the teats.

Prevention.—1. Isolation (for six to eight weeks) must be prompt and effectual. The case is notified, and school authorities should also be informed as to the danger of allowing children from infected houses to mix with the others in school.

2. All excreta, linen, &c. thoroughly disinfected.

3. The skin must have thoroughly peeled before the child is allowed to mix with others. It should be lubricated daily with olive oil containing a little carbolic acid, and a gargle of weak Condy's fluid may be used daily during convalescence, since there is subsequently a great liability to an attack of diphtheria.

38. *Measles and Whooping Cough.*—The deaths from measles number about 12,000 annually, and of these 90 per cent. under five. After an incubation period of about ten days, measles commences with a violent cold, the eyes water, and there is a cough. The cold lasts for four days before the rash is seen. This appears on the forehead first, at the roots of the hair, as small, oval, pinkish spots. The disease is most infectious in the first stage, that of the cold, and it is therefore most difficult to arrest its dissemination. Measures of isolation are not early enough, as the disease cannot be diagnosed before the rash appears. In 1889, Hanley, in Staffordshire, suffered from a serious epidemic. The epidemic flourished and continued to increase as long as the elementary schools were kept open; partial closure led to a diminution, and about ten days after complete closure the disease declined remarkably. The elementary schools were therefore the centres of infection. The school accommodation in Hanley was lamentably deficient, and the over-crowding excessive. *Whooping Cough* causes 12,000 deaths annually. After an ordinary cold and cough, lasting for about a week—during which it is most contagious—the peculiar symptoms appear. Many severe attacks of coughing occur during the day, followed by a peculiar whoop. The disease lasts on an average about six weeks.

In both measles and whooping cough, though not yet generally accepted as notifiable diseases (see "Sanitary Law," April number, 1893), on recovery the clothing and rooms should be disinfected. The patient should be isolated for about four weeks.

39. *Typhoid or Enteric Fever.*—The number of deaths per annum on the average is 7,000, and the greatest number of cases occur between the ages of 15 and 25. It is commoner in country districts than in towns with efficient drainage. Since it is most prevalent in the autumn (October and November), it has been termed autumnal fever.

Symptoms.—In a typical case there is an incubative period of about twelve days, then the disease commences with headache, loss of appetite, weakness, aching in the limbs, and sometimes vomiting. The fever rises gradually until about the fifth day it reaches 105° Fahrenheit, and there remains for a week. The face becomes flushed, the tongue is red at the tip and edges, but furred elsewhere, and the lips are parched, dry, and cracked. The abdomen is tender, and about the tenth day rose-coloured spots become visible upon it. There is generally intense diarrhœa, and some bleeding occasionally from the bowel. The Peyer's patches of the ileum (see "Elements of Physiology," by the author) are especially attacked, and become thoroughly disorganised. They ulcerate and bleed, or the bowel in this situation may give way and lead to a rapid death. During the third week the patient may die from general exhaustion, from weakness of the heart, from excessive diarrhœa, or from perforation of the bowel; or he may die earlier, at the end of the first week, if the temperature reaches a dangerous height, as 107°.

Nature and Dissemination.—There is a specific microbe—a mobile bacillus, which forms spores. It has been found in the Peyer's patches, in the spleen, liver, and the excreta of typhoid patients. The bacillus having entered the body, and finding conditions favourable to its growth, begins to spore. These spores being cast off in the excreta find their way into the soil, into drains, and sewers; or they may enter the water supply, where the water of springs passes through soil infested with these spores. The *De Novo* theory assumed that under certain conditions of soil contamination with excreta, leaking drains, &c., the bacillus may become evolved from some harmless bacterium. But this bacillus of typhoid is a distinct species, produces a distinct and definite disease, which runs a characteristic course. The drinking of water contaminated with ordinary sewage matter may produce diarrhœa, and some fever, or the inhabitants may drink it without producing any harmful results for years, but immediately the excreta from a typhoid patient gain access, the disease spreads rapidly. In nearly every case it is the water which carries the noxious germ. It is possible that typhoid excreta, if dried, may be blown about, breathed, and produce the disease. This is still unproven. Typhoid has been confined in its outbreaks, again and again, to particular houses supplied by certain wells, or to a series of streets supplied by a certain water company. In some instances the disease has been spread by the agency of milk, probably from the milk cans having been washed with water containing typhoid germs.

Prevention.—1. All excreta must be disinfected by a 2 per cent. solution of $HgCl_2$ (the addition of a little common salt facilitates the solution of the sublimate in water) for two hours. The bed linen, &c. which has been soiled must also be disinfected, and the bedding, &c. sent to a steam apparatus.

2. *The Water Supply* must undergo a careful scrutiny, and offending supplies closed. A proper system of sewerage must be constructed. Since the adoption of purer water supplies, and the institution of sewage works, the death-rate from typhoid has fallen from ·3 per 1,000 to about ·1.

40. *Typhus Fever* was called jail fever by Howard. It is now comparatively a rare disease. The predisposing causes are dirt, poverty,

distress, and overcrowding. It has decimated demoralised armies in the past, and formerly prevailed to an alarming extent in prisons, even up to the middle of the present century.

Symptoms.—After an incubation period of about twelve days, the patient shivers, complains of headache, pain in the back, and general *malaise*. Temperature may rise to 105° on the fifth day. On this day an irregular pink rash appears, and the skin appears mottled, the face flushed, and the tongue furred. Contrary to typhoid fever, the patient suffers from constipation. On the fourteenth day there is usually a sudden improvement, and strength is rapidly regained. Typhus is thus not half so serious as typhoid, though, up to forty years ago, both were classed as the same disease.

We know less about the causes of typhoid, inasmuch as no bacillus has been found. There seem to be some grounds for believing it to be a mitigated form of the "plague." It is most contagious at the end of the first week, and is little influenced by season.

Prevention.—Free ventilation renders the poison exhaled from the bodies of patients quite innocuous. The breath is poisonous, and it is dangerous to approach too near. The skin may be kept covered with olive oil, and the same process, with regard to excreta, linen, and bedding, practised as mentioned under typhoid.

41. *Marsh Diseases.*—There are some localities within the tropics where malarious diseases give rise to half the total mortality. We recognise the action of malaria in intermittent fever (ague), remittent fever, malarial cachexia, &c. Within the tropics the type is generally remittent, that is, the symptoms abate periodically, but do not altogether cease. It is when the level of a marsh is lowered, and the soil exposed to the drying effects of the sun, that the poison leaves the ground in abundance. The eucalyptus is planted extensively in the Roman Campagna and in Algeria to prevent and intercept the passage of the poison through the air. The tree grows rapidly, and turns the energies of the soil to better account. There is some difference among authorities as to the nature of the poison; whether it is a bacillus, or an amœboid organism which attacks the red corpuscles of the blood, is not yet settled. Certainly the virus is present in the soil, and is largely influenced by the rainfall. Complete submersion will check its escape into the air, and it is revivified by measures involving the disturbance of soil which has been long quiescent. Malarious influence is most powerful at sunrise and sunset. In England, ague has been practically banished from the Fens, but it still infests the Roman Campagna; it is common at Calcutta, and prevails along the banks of the great rivers of South America.

Preventive measures consist (1) in drainage, which lowers the subsoil water; (2) removal of decaying vegetable matter, and converting the naked soil into meadow land; (3) in the erection of houses and the paving of streets; (4) in boiling all water, in such districts, used for drinking purposes; (5) in the administration of quinine—several grains daily.

42. *Cholera.*—Epidemics have occurred in London during the years 1848, 1854, and in 1866; and the greatest number of cases during the last in houses supplied by the East London Water Company.

Symptoms.—After an incubation period of two to three days, alarming diarrhœa and frequent vomiting occur, accompanied by intense thirst, and a livid countenance. The temperature falls some degrees below the normal, cramps set in, and the patient dies from sheer exhaustion. In some cases a slight premonitory diarrhœa exists for some days.

The Nature of the Disease and its Dissemination.—The specific germ is a bacillus, shaped like a comma (Koch). Seen under the higher powers of a microscope, it possesses powers of very rapid motion. It is found in the mucous membrane of the intestine, and in the rice-water discharges from the bowel. After neutralising the gastric juice by means of sodium carbonate, and paralysing the intestine by means of opium, Koch succeeded in producing the disease in guinea-pigs on feeding them with the bacillus. It is necessary to neutralise the acid of the stomach, since the latter is destructive to the bacillus. Koch thinks the bacillus is always swallowed, either through water or food, as milk; and he found the same bacillus in a water-tank in India. It is, therefore, only when the acid of the gastric juice is deficient that the bacillus has a chance of escaping from the stomach and reaching the intestines in a living state.

Prevention.—1. Prompt isolation in a special hospital.

2. Soiled linen and excreta in corrosive sublimate; clothing and bedding to Lyon's apparatus, and room disinfected afterwards with moist chlorine gas.

3. During time of epidemic all water and milk must be boiled, and the food kept with great care.

4. Quarantine (or the detention of vessels outside the seaport for a certain number of days), especially where no actual sickness exists on board, but merely because they come from an infected port, is unjustifiable. In England, where quarantine is deprecated, and discarded as a clumsy and useless procedure, ships coming from infected ports are detained outside until the medical officer of the port has visited them. Those sick of cholera are removed to the Port Sanitary Hospital, and any suspected persons kept for two days under observation. It has been suggested that, in the case of ships making short trips, as Ostend and Calais to Dover, these should be kept in quarantine (if there be, say, cases of cholera at Ostend or Dover) for two days, to give cholera time to show itself and prevent its introduction into England. This would be excessively irksome, and probably useless. England regards her *first line of defence* as efficient medical inspection and energetic sanitary administration of her seaports. Inland places are now much better able to resist its invasion than thirty years ago. In maps of Havre constructed during the epidemic of cholera last year, and during an outbreak of typhoid in 1888, it is seen how remarkably alike the two diseases were in distribution; and one factor therefore appears to be deficient subsoil drainage. The two great dangers are—(1.) The water supply becoming tainted with the discharges of cholera patients; (2.) The breathing of air fouled with effluvia from contaminated soils, since the cholera bacillus may grow and multiply there, and be discharged into the air. It has been well said, that "Pure air, pure water, pure soil" are the best safeguards against cholera.

5. During the last autumn, Haffkin, in Paris, working in Pasteur's laboratory, has inoculated himself and others with a mitigated form of the cholera virus, and asserts that it is protective. It remains to be seen how this method of inoculation will succeed during the summer of the present year, when cholera is expected, and will most certainly break out again on the Continent. The water supply of Hamburg was criminally inadequate with respect to purity. The Local Government Board (1883) gave special powers to the Sanitary Authorities of seaport towns to deal with cases brought there in ships, and they especially insisted upon the fact that if the water supply becomes tainted by house refuse, as where there is leakage from sewers and cesspools into streams, springs, wells, or reservoirs, and if the cholera discharges not disinfected pass into the sewers, the disease will spread. An Order prohibiting the importation of rags was in force during 1885, when cholera raged in Spain, and may still be put in force.

43. *Sewage, its treatment*, &c.—There are several methods of dealing with sewage; *e.g.*—(1.) Subsidence. (2.) Precipitation by lime, iron, or alumina, or by Webster's process. (3.) Sterilisation and precipitation. (4.) Irrigation. (5.) Dry methods.

Sewage contains about ·4 per thousand part of suspended matters, inorganic and organic, some in solution, and some in suspension. The sewage of London empties into large reservoirs, where the suspended matters are permitted to subside before allowing its escape into the Thames. In some towns lime is added, the CO_2 of the sewage becomes carbonate, which, falling as a precipitate, carries down with it some of the organic matter, and thus clarifies the liquid. The lime may be combined with alumina. The precipitate, or sludge, as it is termed, is worthless in processes where lime is used. Herring brine has been used in conjunction with slaked lime, the latter to precipitate, and the former (which contains certain amines) to sterilise the liquid by destroying the vitality of bacteria. The effluent from these methods is sent into the nearest watercourse. In the A B C processes, a mixture of clay, charcoal, alum, and a little blood is used. A clear effluent is the result. The sludge is pressed and dried, and is said to contain ammonia and 5 per cent. phosphates, being of some value as manure. In Webster's, the electrolytic process, the sewage runs along long troughs containing iron plates connected with a dynamo. The chlorides in solution are decomposed, a hypochlorite of iron being formed at the positive pole, is decomposed by the sodium and ammonium bases, hydrate of iron falls as a precipitate, and carries organic matter down along with it.

44. *Irrigation.*—If applied efficiently to land, the sewage is purified and leaves its filth in the soil. The effluent may be passed into rivers. There is always a difficulty where rain water runs along with the sewage. The most successful cases of sewage irrigation are in those towns where the separate system is used, in accordance with the phrase, "rain water to the river, and sewage to the soil." In such towns, the sewage is a definite quantity entirely uninfluenced by rainfall.

Irrigation may be either *surface*—that is, *broad*—irrigation, or *intermittent filtration*. In the former, the sewage is distributed over a large surface, with a view to a maximum growth of vegetation for the amount of sewage supplied. The latter is delivered in special channels to the land, which is well drained. The best soil is a sandy loam. There should be about one acre to every 100 persons. The sewage must be applied intermittently, otherwise the ground may become waterlogged. There should be a rotation of crops, as rye-grass, carrots, peas, cabbages. Such sewage farms exist at Croydon, Cheltenham, &c. It is still a disputed point as to whether parasites may not be communicated to animals eating the crops raised off unfiltered sewage.

45. In *intermittent downward filtration* the sewage is concentrated at short intervals on an area of specially chosen porous ground, as small as will absorb and purify it; not excluding vegetation, but

making the produce of it of subsidiary importance. The sewage may be previously precipitated by means of lime. The surface is arranged in beds, which slope towards the main drain, and it is ploughed in ridges on which vegetables may be planted. The sewage passes from carriers along the raised margins of the beds into the furrows, and soaking through the soil, is carried off by deeper drains about 6 feet below the surface. The effluent is bright and pure.

46. *Dry Methods.*—(1.) Dry earth or Moule's system. (2.) The pail system. Moule's earth closet consists of a wooden box with a receptacle below, and a quantity of dry earth above, which falls on the sewage when the plug is pulled. The earth is previously dried. The receptacle is emptied from time to time, and may be used as manure. Rich garden mould is best. The disadvantages are—(1) The difficulty of securing proper attention and removal of the product; (2) Its insignificant value as manure. The deodorising is a destructive process, due to the conversion of the ammonia compounds into nitrates and nitrites through the agency of certain bacteria in the soil, and some of the nitrogen escapes free. Dryness of the earth is essential for success. Other substances, as charcoal, soot, &c., have been used in place of earth. Its advantages are, if intelligently managed, it disposes of excreta without a nuisance, and as compared with the water-closet it is cheaper, and requires less repair; it is not injured by frost, and less water is required for the household. The method has been applied to schools, barracks, volunteer camps, and public institutions, both in England and India. In villages provided with earth closets, the slops may be disposed of by sub-irrigation. The slop waters pass into drains, which are unjointed, and about a foot below the surface. Through the joints the slop water escapes into the soil, and is carried off by a deeper set of drains, and then allowed to enter the water courses. In the *pail* system, used in some towns in Yorkshire and Lancashire, the solid and liquid excreta pass into pails which are periodically removed at short intervals. It may be applied to land, provided it be at a distance of at least 1,000 feet from houses, or it may be taken to a manufactory, dried, and converted into manure (poudrette).

47. *The Rivers Pollution Act* (1876) forbids the contamination of watercourses with crude sewage, since the solids are there precipitated and obstruct the bed of the stream: cattle cannot drink the water passing through the meadows; dwellers near the river side cannot bear the smell; the effluvia arising from the stream induce dyspepsia and diarrhœa, and the property along the banks becomes unsaleable. Moreover, the fish are killed. Most destructive to aquatic animals are such substances as copper and iron sulphates, caustic potash, mineral acids, &c. Sewage may be to some extent purified, no doubt, by deposition of its suspended material, by the growth of certain plants, and by oxidation. Authorities differ, however. Frankland's experiments showed that sewage oxidizes very slowly, whereas the late Dr. Letheby asserted that sewage is perfectly oxidized after a flow of nine miles, if mixed with 20 times its bulk of water. When sewage passes into a stream, it must have been previously treated by some of the above processes. The sewage of London is conveyed to Barking and Crosstrees, below Woolwich, where the outfall sewers terminate in large covered reservoirs. The sewage is only discharged into the river at certain times of the tide. Commencing at high water, it flows for about 3 hours, when the outflow is closed and the sewage collects again. In the case of rain storms the reservoirs overflow, and the surplus is discharged directly, and at once. It must be a mixture of rain and sewage. The disadvantages are obvious. Fortunately the water companies have ceased, for many years, taking in water about Battersea. At present there are 3 sources of water for London—(*a*) the Thames, (*b*) the Lea, (*c*) deep wells in the chalk. The water companies take in water above Teddington, where there is no possible contamination with sewage, as the tide does not reach so far. But there is a population of 500,000 along the banks of the Thames above Teddington. The companies certainly store the water and allow it to percolate through filter beds of fine sand and gravel, but this does not remove bacteria. Most of the towns above Teddington purify their sewage, others do not. It should be made compulsory.

In seaports the sewage may flow into the sea, but the terminal sewers must be carried to low water, and should always be under water (just as should be the case if they discharge into rivers), otherwise the wind blows up the sewers, and may drive sewer gases through traps, &c. There should be a flap opening outwards to keep the sea water from entering.

48. Among the above processes, broad irrigation removes about 60 per cent. of organic carbon and nitrogen, intermittent filtration 75, and chemical processes about 130. The standard of purity for effluent water has not yet been fixed. Certainly the organic carbon should not be more than 3, and the organic nitrogen not more than 1 in 100,000 parts.

The best plan for disposal of sewage depends upon circumstances. Some towns have no water to spare, or the situation is such that a sufficient slope cannot be obtained. But the best plan, under favourable circumstances, is the water sewerage plan, with or without the inclusion of rain water. After the treatment of the sewage by irrigation (broad irrigation or intermittent downward filtration), the effluent is allowed to escape into the nearest stream.

49. *Free Ammonia and Albuminoid Ammonia in Drinking Water.*—To estimate the total solids in water, 70 cubic centimetres of the water are placed in a porcelain dish, and after evaporation the increase of weight of the dish is determined. Each milligram of residue is equal to 1 grain of total residue in a gallon of water. For the ammonia and organic matter, Wanklyn's method is still largely used. The nitrogenous compounds are converted into ammonia when boiled with permanganate, and the ammonia is expressed in milligrams per litre. The solutions required are Nessler's, standard ammonia, carbonate of soda, and permanganate of potassium. The standard ammonia contains a quantity of ammonium chloride equal to 1 milligram of ammonia in every cubic centimetre.

Method.—Into a retort place 500 c.c. = ½ litre of the water, and 10 c.c. carbonate of soda solution. Distil over 50 c.c. into a glass, and determine the quantity of ammonia by Nessler's solution. The next 150 c.c. distilled are thrown away, as it is known that the first 50 c.c. contain ⅔ of the ammonia present as chloride, or sulphate, or carbonate, which is called the *free ammonia*. Now there are 300 c.c. left in retort. Add 50 c.c. of a solution of potash and permanganate of potassium. Then three separate distillates, each containing 50 c.c., are distilled over and Nesslerised. The amount of ammonia is determined thus:—To the first 50 c.c. add 2 c.c. of Nessler's solution (a double iodide of mercury and potassium, which is turned brown by ammonia). Then imitate the depth of the colour by mixing more or less of the standard ammonia to 50 c.c. distilled water containing 2 c.c. of the Nessler solution, and determine in this way. The last three distillates, after addition of permanganate, give the albuminoid ammonia—that is, the ammonia derived from organic bodies. Not all organic compounds liberate their ammonia in this way, and in so far the method is defective. Frankland prefers to combust the residue after evaporation, and determine the carbon as CO_2, and the nitrogen in the free state.

The albuminoid ammonia, however, multiplied by 10, gives a fair estimate of the organic nitrogeneous matter in the water. Potable water should not contain more than ·005 of free, and ·01 albuminoid ammonia per 100,000 parts. Rain water often contains a large quantity of free ammonia, and is still harmless. In shallow wells, if there is much free ammonia and chlorides, the water is dangerous. A large amount of albuminoid ammonia, with little free ammonia and chlorides, denotes vegetable matter. A large amount of albuminoid ammonia, with much chlorides, denotes sewage contamination. Chemical methods must be aided by a knowledge of the source of the water, and the possibilities of its pollution; for a minute quantity of a specific—*e.g.*, typhoid or cholera virus—might enter, be unrecognised by the chemist, and still render the water intensely dangerous.

50. *Summary.*—Diseases attributed to impure water are (1.) diarrhœa and dysentery; (2.) typhoid fever; (3.) cholera; (4.) ague in malarious districts; (5.) goitre; (6.) lead poisoning, &c.

Diseases attributed to the soil are—Rheumatism and neuralgia, to damp, clay soils; to alluvial soil with much organic matter, malaria: to soil with sewage contamination, typhoid (?), cholera (?), diphtheria (?), diarrhœa, &c.

Questions set by the Science and Art Department.

(9) What are the conditions which favour the spread of enteric fever? Discuss the question of the *de novo* origin of this disease (1888).

(10) Upon what principle does the dry-earth system for the treatment of excretal matters depend? Under what circumstances is its adoption to be recommended? (1888.)

(11) Under what circumstances are marsh diseases found? What are their characteristics? What measures of prevention should be adopted? (1887.)

(12) What are the distinctions between typhus and typhoid fevers? Contrast the methods of prevention? (1889.)

(13) What evils are likely to attend the discharge of sewage (*a*) into non-tidal rivers, (*b*) into tidal rivers, and (*c*) into the sea? (1890.)

(14) In what way do soils affect health? Explain what is meant by *ground air* and *ground water*. What influence have these on the healthiness of a place? (1892.)

(15) Discuss the significance of free ammonia, and albuminoid ammonia in drinking water. Whence may they be derived, and what may they indicate? (1892.)

OCCASIONAL EXAMINATIONS.

London School Board Scholarships.

In December and January last examinations were held under the authority of the School Board for London, for the purpose of determining the award of some fifty scholarships placed at the disposal of the Board. Of these, one was a Technical Scholarship offered by the Clothworkers' Company; twenty for boys and ten for girls were offered in connection with Christ's Hospital; five were offered by the Drapers' Company; seven were Mitchell's Scholarships, specially for children born in the City or of parents employed in the City; and the rest provided by other donors. Nineteen were awarded to girls, and thirty-one, including the Technical Scholarship, to boys. The number of Scholarships available this year being larger than usual, the number of candidates was also larger, and it is satisfactory to learn that the competition was keener.

The examinations consisted of preliminary, intermediate, and oral examinations. The first included the subjects of Arithmetic, English Grammar and Composition, History and Geography, Drawing for boys only, and Needlework for girls only. It was held on the 12th and 13th of December, at five different centres, and was attended by 189 boys and 120 girls out of 199 boys and 125 girls who had entered for competition.

The intermediate examination, open only to those who obtained a satisfactory proportion of marks in the preliminary tests, was held on the 28th and 29th of December. It was attended by 91 boys out of 92 qualified, and by 42 girls. In this examination papers were set in the following subjects:—Drawing (for girls only), Animal Physiology, Mechanics, Chemistry, Algebra, Euclid, Domestic Economy, Botany, French, and Latin. Each candidate was allowed to select two subjects from the list.

The oral examination, held on two days in January, was open only to those who had obtained a certain proportion of marks—not less than 55 per cent for boys, and not less than 50 per cent. for girls—in the two written examinations. It included Reading, and oral questioning with a view to testing intelligence, readiness, and general aptitude. 41 boys and 38 girls were thus examined, and from them the successful competitors were chosen.

For the Technical Scholarship twenty candidates were examined, and wood-work was one of the subjects in which they were tested.

The general examinations were conducted by Mr. Pinches, B.A., who has had charge of previous Scholarship Examinations for the Board, and it must be gratifying to find that he is able to report so much improvement in almost every branch.

As the papers of questions are likely to be useful to many of our readers in testing the work of their own pupils, we have pleasure in placing them within their reach. We append answers to the questions in Arithmetic and Algebra.

Questions set at the Preliminary Examination:—

ARITHMETIC.

(*Time allowed: Three hours.*)

(All the working must be shown.)

1. Express in words the product of MDCCC. and XLIX.

2. How many pats of butter, 1¼ lbs. each, can be made out of one ton of butter?

3. Find the value of a piece of timber 37 ft. 6 ins. long, and 2 ft. 7 ins. thick each way, at 2s. 6d. per cubic foot.

4. If a person spends in four months as much as he earns in three, how much can he lay by annually, supposing that he earns £250 10s. every six months?

5. If the rent of 39 acres 2 roods 20 poles is £148 11s. 10½d., what is the rent of six acres?

6. If 35 bushels of oats last 7 horses for 20 days, how many days will 96 bushels last 18 horses?

7. What is a Vulgar Fraction, and how is it expressed?

Simplify $\dfrac{1\frac{3}{4}\text{ of }1\frac{1}{7}}{3\frac{2}{5}+\frac{5}{1\frac{1}{11}}}+\dfrac{4}{5+\frac{6}{7+\frac{2}{3}}}$.

8. Subtract ·992748 from 1; divide the result by ·0074, and prove the correctness of your division by vulgar fractions.

9. What decimal of 1 cwt. is 2 qrs. 16½ lbs?

10. Find, by Practice, the cost of 2 cwt. 2 lbs. 2 ozs. 12 drs. at £1 3s. 9d. per lb.

11. Explain the meaning of *Interest*, and distinguish between *simple* and *compound* interest.

Find the difference between the simple and compound interest on £2,000 for three years at 7½ per cent.

12. Find the discount at 4½ per cent. on £587 18s. 9d., due six months hence.

13. By selling a carriage for £73 3s. I should lose 5 per cent. At what price must I sell it to gain 15 per cent.?

14. A man has £3,430 stock in the 3½ per cents. at 83½; when the stock rises 2 per cent. he transfers his capital to the 4 per cents. at 98; find the alteration in his income.

15. Divide £925 among A, B, C and D, giving B ·916 of A's portion, C ·375 of B's, and D half as much as B and C together.

16. A can do a piece of work in 10 days, B in 9, C in 12. They all begin it together, but only C continues till the work is finished, A leaving it 3⅓, and B 2⅔ days before its completion. In what time was it performed?

ENGLISH HISTORY AND MODERN GEOGRAPHY.

(*Time allowed: Three hours.*)

1. Explain the following terms—*parliament, franchise, freehold, heir-presumptive, alien, queen-dowager, feudal tenure.*

2. Write down, with the dates of their accession, the successive sovereigns of the House of Tudor. How did the crown come into that family?

3. When, by whom, and in what way, were Wales, Ireland, and Scotland united to England?

4. Give some account of *three* of the following persons—Thomas à Becket, Edward the Black Prince, Sir Thomas More, John Hampden, John Duke of Marlborough, Arthur Duke of Wellington.

5. State briefly what you know about—
   (1) The war with France in the reign of Henry V.
   (2) The Petition of Right.
   (3) The Act of Settlement.
   (4) The Conquest of Canada.

6. Give the position of the following places, and state with what event in English history each is connected—Bannockburn, Tewkesbury, Utrecht, Trafalgar, Plassey, Blenheim, the Crimea.

7. Explain the following terms—*peninsula, isthmus, affluent, range of the tide, arctic circle, torrid zone.* What is the distance, both in degrees and in ordinary miles, between two places on the same meridian, one being 13½° South latitude, and the other 14° North latitude.

8. Name and give the position of fifteen large towns in the British Isles, and state briefly one fact in connection with each.

9. What are the chief articles of food imported to England, and from what countries are they respectively obtained?

10. Give the position, as exactly as you can, of *ten* of the following places, and state one fact in connection with each—Dresden, Astrakhan, Sydney, Washington, Lima, Panama, Dunedin, Delhi, Yokohama, Rangoon, Canton, Singapore, Monte Video, Ispahan, Gibraltar.

11. Give the names of the Australian Colonies, with the chief towns and principal products of each; *or*, describe generally the West India Islands, and the nature of their commerce.

12. Draw an outline map of Africa *or* North America showing the political divisions, chief physical features, and position of ten large towns.

ENGLISH GRAMMAR AND COMPOSITION.

(*Time allowed: Three hours.*)

1. Parse the following sentence—

> "He shall do this, or else I do recant
> The pardon that I late pronounced here."

2. Analyse the following passages—
   (1) The Russian gunners, after the storm of cavalry had passed, returned to their guns.
   (2) "As the tall ship, whose lofty prow
   Shall never stem the billows more,
   Deserted by her gallant band,
   Amid the breakers lies astrand,—
   So, on his couch, lay Roderick Dhu!"

3. Explain the following terms, and give one example of each—*monosyllable, diphthong, prefix, defective verbs, adjective clauses.*

4. Write the plurals of the following words — *book, hero, grotto, life, fife, deer, melody, formula, radius, delay, phenomenon, appendix, crisis.*

5. Explain the use of adverbs. Give the degrees of comparison of the following adverbs—*ill, well, little, much, often, seldom.*

6. How are adverbs classified? Give the third person singular of the past (preterite) tense, and the perfect participle of—*wind, eat, tread, bereave, catch, tear, shoe, betake.*

7. Separate the roots from the other parts in the following words, and show the precise effect of each of the additions—*unkind, antichristian, singer, duckling, kingdom, subterranean.*

8. Give in your own words the meaning of the following passage—

"For many a petty king ere Arthur came
Ruled in this isle, and ever waging war
Each upon other, wasted all the land:
And still from time to time the heathen host
Swarm'd over seas, and harried what was left.
And so there grew great tracts of wilderness,
Wherein the beast was ever more and more,
But man was less and less, till Arthur came."

9. Correct the following sentences, giving your reasons—
(1) Homer, as well as Virgil, were read by him with delight.
(2) Thoughts are only criminal when they are first chosen and then voluntarily continued.
(3) This injury has been done me by a friend, he whom I treated like a brother.

10. Supply the proper capitals, stops, and inverted commas in the following passage—

let me see said the captain what is the force of gravity upon the various planets you cannot mean said richard that you have forgotten that but you always were a disappointing pupil.

11. Write a short essay on *one* of the following subjects—
(1) The advantages of railroads.
(2) A holiday in winter.
(3) Delays are dangerous.

DRAWING.

(*Time allowed: Two hours.*)

FREEHAND.

Candidates are required to copy in pencil carefully the printed example, increasing the height about three inches, and the width in proportion. No ruling or measuring of any kind is allowed.

GEOMETRICAL.

1. On a line two inches long construct a square.

2. Construct a triangle, the sides measuring 1½, 2, and 3 inches respectively,

3. Inscribe a circle in an equilateral triangle of which one side is 1 inch.

4. Construct a regular pentagon of which one side is one inch.

5. In the circle of which the radius is one inch, inscribe four equal circles, each touching two others and the circumference of the larger circle.

NEEDLEWORK EXAMINATION.

(*Time allowed: Two hours.*)

The following exercises must be worked consecutively:—
The materials for the respective exercises are lettered A, B.
The materials marked A must be used for exercise A; B for exercise B.

A. Gather and stroke down 7 inches, fix it into a band of 3 inches, and set in both sides of 1½ inches=half the band. Work a buttonhole on the band, and sew on a string (at the side of the band).

B. *Sew* and fell together 1 inch of two pieces of calico, and put in a gusset as for the body of a shirt, and stitch the gusset across.

QUESTIONS SET AT THE INTERMEDIATE EXAMINATION.

ANIMAL PHYSIOLOGY.

(*Time allowed: Two hours.*)

1. Enumerate and describe the teeth in the lower jaw of man, and compare them with those of (1) a horse, and (2) a dog.

2. Name a dozen bones of the human skeleton, mentioning where they are situated.

3. Describe the structure of a muscle, and explain its properties.

4. Describe fully the construction and action of the elbow-joint.

5. What are the uses of the saliva, the bile, the pancreatic and gastric juices respectively?

6. Describe the process of respiration, and the changes which take place in the gases concerned.

7. What is the composition of the blood? Its ordinary temperature?

8. Contrast the blood in the two ventricles of the heart.

9. Describe the structure of the eye in man, and compare it with that of any insect.

10. Describe the spinal cord in Man; its connection with the nerves, and its connection with the brain.

MECHANICS.

(*Time allowed: Two hours.*)

1. Mention some of the distinguishing characteristics of *solids, liquids,* and *gases.*

2. Define acceleration, and explain how it is measured. What velocity must a body have so that, if retarded 10 feet each second, it may move over 45 feet before coming to rest?

3. Define stable and unstable equilibrium, and give an example of a body in each state.

4. A person holds a walking-stick in a horizontal position by one hand near the end. What are the forces acting on the stick, and why is it more difficult to hold it in this way that near the middle?

5. Find the relation between the power and the weight with a screw turned by a lever of given length.

6. Enunciate the proposition of the parallelogram of velocities, and show how it may be experimentally verified.

7. A uniform straight lever 3 feet long, weighs 4 lbs. What weight on the shorter arm will balance 10 lbs. on the longer, the fulcrum being one foot from the end?

8. State the law of equilibrium of different liquids in communicating vessels.

9. A diving-bell is sunk in a lake until it is two-thirds full of water. Assuming 34 feet of water to produce a pressure of one atmosphere, calculate the depth of the surface of the water in the bell, and the pressure of the contained air.

10. Describe the common pump. Why is the lower tube narrower than the upper?

CHEMISTRY.

(*Time allowed: Two hours.*)

1. Define—*chemistry, element, mixture, compound, elective affinity, atomic weight.*

2. Describe any two experiments which tend to prove the indestructibility of matter.

3. What is the composition of water by weight, and how may it be experimentally determined?

4. How would you prove *experimentally* that atmospheric air contains oxygen?

5. Describe two processes for the preparation of chlorine. Give an equation and a sketch of the apparatus in each case.

6. Describe the properties of carbon monoxide. Under what conditions is it formed as a product of combustion?

7. Give an account of carbonic acid gas—its properties, uses, and method of preparation.

8. If steam be passed through a tube containing iron filings red-hot, what takes place? Give equation.

9. Slips of litmus and turmeric paper are put into (1) dilute nitric acid, (2) solution of potash, (3) solution of ammonia, (4) solution of carbonic anhydride, and (5) solution of potassic chloride. Describe what occurs in each case.

10. Write out the various names by which the following compounds are known:—Fe_2O_3, CuO, Cu_2O, BaO, NaHO, SO_3, K_2SO_4, $KHSO_4$.

ALGEBRA.

(*Time allowed: Two hours.*)

1. A person walked x yards every minute, and after thus walking for y minutes he found he had walked 40 yards further than he had intended. Express algebraically the distance he intended to walk.

2. Add the sum of $2y-3y^3$, and $1-5y^3$, to the remainder left when $1-2y^2+y$ is subtracted from $5y^3$.

3. Simplify $5x-3\left[2x+9y-2\left\{3x-4\left(y-x\right)\right\}\right]$.

4. Divide $2x^5-x^4y-4x^3y^2+5x^2y^3-4y^5$ by $x^3-xy^2+2y^3$.

5. What do you understand by the *factors* of an algebraical expression? Resolve into their factors:—

(1.) x^2-y^2.

(2.) x^3-2x^2-3x+6.

6. Reduce to its lowest terms $\frac{x^4-2x^3+x^2-1}{x^4+x^2+1}$.

7. Simplify $\frac{2a^2}{b^2-4a^2}-\frac{a}{b+2a}+\frac{a}{2a-b}$.

8. Extract the square root of $x^6-4x^5+6x^3+8x^2+4x+1$.

9. Solve the following equations:—

(1.) $\frac{2x+7}{7}-\frac{9x-8}{11}=\frac{x-11}{2}$;

(2.) $\frac{ax-b}{c}+a=\frac{x+ac}{c}$.

10. A sum of money consists of fourpenny pieces and sixpences, and it amounts to £1 16s. 8d. The number of coins is 78. How many are there of each?

11. Solve the following equations:—

(1.) $\frac{x-1}{8}+\frac{y-2}{5}=2$, and $2x+\frac{2y-5}{3}=21$;

(2.) $x^2-13x=140$;

(3.) $x-y=12$, and $x^2+y^2=74$.

12. A and B working together can earn 40 shillings in 6 days; A and C together can earn 54 shillings in 9 days; and B and C together can earn 80 shillings in 15 days; find what each man can earn alone each day.

13. Divide 16 into two parts such that their product added to the sum of their squares may be 208.

EUCLID.

(*Time allowed: Two hours.*)

1. Define—a *plane rectilineal angle*, a *parallelogram*, and a *gnomon*; and explain the meaning of the terms *postulate*, *axiom*, *converse proposition*.

2. From a given point draw a straight line equal to a given straight line.

3. Prove that if two angles of a triangle are equal to each other, the sides which are opposite to the equal angles are equal.

What is a corollary? What corollary is deduced from this proposition?

4. Prove that any two sides of a triangle are together greater than the third side.

If two sides of a triangle are 6 and 7 inches long respectively, what is the greatest, and what the least length possible for the third side?

5. The side NT of a triangle RNT is produced to Y: prove that the angle RTY is equal to the sum of the angles TRN and RNT.

6. To a given straight line apply a parallelogram which shall be equal to a given triangle, and have one of its angles equal to a given rectilineal angle.

7. If a straight line be drawn through the middle point of one side of a triangle, parallel to the base, prove that it will bisect the other side.

8. If a straight line be divided into any two parts, prove that the rectangles contained by the whole and each of the parts are together equal to the square of the whole line.

9. Divide a straight line DF into two parts, so that the rectangle contained by the whole and one of the parts shall be equal to the square of the other part.

10. Show that the square on the base of an isosceles triangle whose vertical angle is a right angle, is equal to four times the area of the triangle.

DOMESTIC ECONOMY.

(*Time allowed: Two hours.*)

1. What are the principal uses of mineral food? Name some forms in which this is taken.

2. Compare the values of beef, mutton, veal, poultry, and fish, under the heads of nutrition and economy.

3. Is the statement that "brown bread is more wholesome than white" correct? Give a reason for your answer.

4. What qualities are especially desirable in the water supplied for domestic consumption? State briefly how they may usually be secured.

5. What circumstances should be taken into consideration in selecting a site for a house?

6. When and how does air cease to be "fresh"? Explain some good system of ventilation.

7. Explain the effects on the body of wearing wet or damp boots and clothing.

8. Give receipts for varieties of milk puddings, with accurate directions as to the proper modes of preparation.

9. How would you treat (1) a severe burn, (2) convulsions? Name some useful disinfectants, and show their importance.

10. Name the habits which you consider the most important aids to the preservation of health.

BOTANY.

(*Time allowed: Two hours.*)

1. How can you distinguish a plant from an animal?

2. Describe the general structure of a leaf. What is its use to the plant?

3. Explain fully the various respects in which a petal differs from a leaf.

4. What part of the food of a plant is taken up by the roots?

5. Describe the chief kinds of aërial stems, and the stems of (1) the rose and (2) the wallflower.

6. From what plants, and from what parts of them, are the following obtained—*sago*, *arrowroot*, *dates*, *indigo*, *mustard*, *sugar*, *pepper*, *yeast*, and *gamboge*.

7. Describe the flower in the Pea, the Hawthorn, and the Anemone.

8. Describe the fruit in the Raspberry and the Currant.

9. What are the different effects of light and heat upon plant growth, and of what importance is the presence of oxygen gas to plants?

10. Give the life-history of a Moss.

FRENCH.

(*Time allowed: Two hours.*)

I. Translate into English.

1. Nous avons perdu mon pauvre frère ce matin à neuf heures moins un quart.

2. Votre cousin n'est-il pas à Paris depuis longtemps?

3. Ne le lui portez pas vous-même, laissez-le venir.

4. Il est arrivé hier de la campagne, il est en visite chez son cousin.

5. J'espère que le chef de la maison de banque, où je suis employé, m'accordera huits jours de congé.

6. De là Pierre le Grand passa en Angleterre, où il se perfectionna dans la science de la construction des vaisseaux; il repassa en Hollande, et vit tout ce qui pouvait tourner à l'avantage de son pays. Enfin, après deux ans de voyages et de travaux, il reparut en Russie, amenant avec lui les arts de l'Europe.

II. Grammatical Questions.

1. Write in the plural masculine—*celui*, *lequel*; and in the singular feminine—*ils*, *le sien*, *chacun*.

2. Translate, in both genders and numbers—*small*, *taller*, *the happiest*.

3. When do the numerals *vingt* and *cent* take an *s*, and when is *mille* spelt *mil*? Give examples.

4. Write out the future indicative and present subjunctive of—*être*, *finir*, *aller*, *savoir*.

5. English compound substantives are translated into French by means of the prepositions *à* and *de*. Explain the use of these prepositions, and give examples.

III. Translate into French.

1. My books are more useful than theirs.

2. Where did you go on Tuesday last?

3. Tell your brother to come to me.

4. I am a stranger; I came from Paris last month.

5. I could not read your writing; you must write better.

6. I think it is going to rain; take an umbrella.

7. She lost the book which you lent to my mother.

8. Give us the pleasure of taking tea with us at five o'clock on Wednesday next.

LATIN.

(*Time allowed : Two hours.*)

I. TRANSLATE INTO ENGLISH.

1. Pater meus est in templo.
2. Magnam arborem video.
3. Deditne puer librum magistro.
4. Antonius et Cæsar victi sunt.
5. Milites fortissime pugnantes occisi sunt.
6. Bello confecto, Cæsar statuit Rhenum transire.
7. Felicem dicere non hoc me possum.
8. In eodem prato pascebantur tres boves in maxima concordia, et sic ab omni ferarum incursione tuti erant. Sed, dissidio inter illos orto, singuli a feris petiti et laniati sunt.

II. GRAMMATICAL QUESTIONS.

1. Decline in full, singular and plural, *hic arcus*, and *clarissima urbs*.
2. Give the genitive singular and plural of *altior*, *dies*, *deus*, *senex*.
3. Decline, singular and plural, the pronouns *ego*, *ille*, *qui*.
4. Give the present and future indicative, and the present and pluperfect subjunctive, of *sum* :
5. Give the principal parts of *moneo*, *regor*, *nolo*, *audeo*, *fero*, *abeo*, *jubeo*.
6. What cases are governed respectively by the prepositions *inter*, *sub*, *propter*, *de* ? Give short Latin sentences in illustration.

III. TRANSLATE INTO LATIN.

1. Wise kings will praise brave soldiers.
2. Many slaves will be sent.
3. Who did this ?
4. Cæsar conquered Gaul in six years.
5. A Roman legion had five thousand foot-soldiers, three hundred horse-soldiers.
6. He departed from Athens and returned to Rome.
7. There is no doubt that we ought always to be learning.
8. Many battles having been fought, the enemy sought peace.

DRAWING.

(*Time allowed : Three hours.*)

FREEHAND.

(Not more than one hour and a half is to be allowed for Freehand.)

Candidates are required to copy in pencil carefully the printed example, increasing the height about two inches, and the width in proportion. No ruling or measuring of any kind is allowed.

GEOMETRICAL.

1. Draw a straight line 5 inches long, and divide it into four parts in the ratio 5, 2, 3, 1.
2. Within an equilateral triangle, altitude 2 inches, describe another, having its sides parallel to, and ½ inch distant from, those of the larger triangle.
3. In a regular pentagon, base 1½ inches, inscribe five equal circles, each circle to touch two sides and two other circles.

PERSPECTIVE.

(The questions in Perspective are only for Candidates for the Technical Scholarships.)

Height of the eye, 5 feet above the ground-plane. Distance of the spectator, 12 feet from the picture-plane. Scale of drawing, ½ inch to 1 foot.

1. Place in perspective a cone, diameter of base 4 feet, height 5½ feet, standing upon the ground-plane upon its circular base; the centre of its base 4 feet to the right of the spectator, and 3 feet within the picture.
2. Place in perspective a regular hexagon, side 3 feet long, lying upon the ground-plane, its nearest angle being 2 feet to the left of spectator, and 3 feet within the picture, its near edge being parallel to the picture.

Answers to Arithmetic Paper.

1. Eighty-eight thousand two hundred.
2. 1493⅛ pats of butter. 3. £3 3*s*. 1$\frac{13}{16}$*d*.
4. £125 5*s*. 5. £22 10*s*. 6. 21⅓ days.
7. 1. 8. ·98.
9. ·65 cwt. 10. £268 11*s*. 6$\frac{8}{11}$*d*.
11. £34 11*s*. 10½*d*. 12. £12 18*s*. 9*d*.
13. £88 11*s*. 14. 6*s*. less.
15. A, £320 ; B, £293 6*s*. 8*d*. ; C, £110 ; D, £201 13*s*. 4*d*.
16. 5$\frac{3}{8}$ days.

Numerical Examples in Mechanics Paper.

2. 30 ft. per second.
7. 22 lbs.
9. Depth of water surface=68 feet, pressure of contained air 45 lbs. per square inch.

Answers to Algebra Paper.

1. $xy-40$ yards. 2. $y-y^2$.
3. $41x-51y$. 4. $x^2-xy-2y^2$.
5. $(x+y)(x-y)$; $(x^2-3)(x-2)$. 6. $\frac{x^2-x-1}{x^2+x+1}$.
7. $\frac{ab-b^2}{b^2-4a^2}$. 8. x^3-2x^2-2x-1.
9. (1) $x=7$. (2) $x=\frac{b}{a-1}$.
10. 64 sixpences, 14 fourpences.
11. (1) $x=9$, $y=7$. (2) $x=20$ or -7. (3) $x=+7$, $y=-5$.
12. A, 3/8 ; B, 3/- ; C, 2/4. 13. 12 and 4.

QUICK'S EDUCATIONAL REFORMERS.

BY THOMAS CARTWRIGHT, B.A., B.SC. (LOND.)

Author of 'Mental Science and Logic for Teachers,' Co-Director of the Birkbeck Training Classes.

I.—JOHN LOCKE.

LAST month in our prefatory remarks we intimated that a short sketch of the life of Locke would be a necessary preliminary to a study of Quick's chapter upon this philosopher. We propose to present the main facts of this life in the present issue.

John Locke was born at Pensford—six miles from Bristol—in 1632. Although his constitution was feeble he reached the respectable age of 72, dying in 1704. He was educated at Westminster School, and at Christ Church, Oxford. He took the Bachelor and Master Degrees, and obtained a Senior Studentship at his College. In 1665 he was at Cleve as Secretary to the English Ambassador to the Elector of Brandenburg, but, upon the conclusion of the mission, he refused to accept diplomatic service in Spain, and returned again to Oxford, where he might follow out his ideal, which is expressed as follows :—'Amidst the troubles and vanities of this world, there are but two things that bring a real satisfaction with them—that is, virtue and knowledge.' He studied medicine, and, in the capacity of doctor, he made the acquaintance of that famous Lord Ashley, afterwards the Earl of Shaftesbury, whom Dryden has so scathingly lampooned in his 'Absalom and Achitophel,' Shaftesbury being Achitophel, and 'a man to all succeeding ages curst.' To the end of his life Locke's goings and comings were dependent almost entirely upon Ashley. He educated both the son and the grandson of this noble, and it was this office which undoubtedly sent those ideas coursing through our reformer's mind which, many years later, gave birth to the 'Famous Thoughts concerning Education.'

In 1667 he left Oxford, and became *amicus familiae* to Ashley. After a short visit to France, Locke was,

in 1672, appointed 'Secretary of Presentations' by his friend Lord Ashley, who had become Earl Shaftesbury, and 'when my lord went to take coach,' Locke had the high privilege of going before him bareheaded. In November, 1673, he was dismissed from his office because he was not able to be sufficiently complaisant with respect to the Treaty of Dover; but 'when my grandfather quitted the Court, and began to be in danger from it, Mr. Locke now shared with him in danger, as before in honours and advantages' (3rd Earl Shaftesbury). So bad was the condition of Locke's health in 1675 that he went to France, and remained there until, in 1679, he was recalled by his patron, now, by the revolution of Fortune's wheel, become Lord President of the Council. After an interval of three years, during which the plot in favour of Monmouth was concocted, Shaftesbury had a narrow escape as to his head, and was glad to find safety in Holland, whither Locke followed him in 1683, not returning until he accompanied Queen Mary in 1689. Whilst in England he had been occupied in the education of the earl's grandson, 'Mr. Anthony,' who makes Locke's position plain in the following words:—'In our education Mr. Locke governed according to his own principles, since published by him, and with such success that we all of us came to full years with strong and healthy constitutions. I was his more peculiar charge, being, as eldest son, taken by my grandfather and bred under his immediate care, Mr. Locke having the absolute direction of my education, and to whom, next my immediate parents, I must own the greatest obligation, so I have ever preserved the highest gratitude.' For two years he travelled about Holland; but was obliged to seek concealment when a list of 'traitors and plotters against the life of James II.' was despatched to the Dutch Government, the last name being John Locke. In 1686 he was pardoned; and at the age of fifty-four his friend Le Clerc, of Geneva, prevailed upon him to tread the thorny paths of literature, by giving his thoughts to the world in the *Bibliothique Universelle*, of which Le Clerc was editor; one of the first things to appear therein was an epitome of the 'Essay on the Human Understanding.' Mr. Clarke, of Chipley, near Taunton, had written to Locke to advise him how to resolve the problem of the education of his son. Locke had written some letters to him, and, four years after his return to England, was prevailed upon to publish the 'Thoughts concerning Education.'

Immediately after his proclamation, William III. would have sent Locke as Ambassador to Cleve; but Locke declined on the double ground of ill-health and inability to drink deep enough to pair off with the Elector of Brandenburg in this respect, he being 'the soberest man in the kingdom.'

The last fifteen years of his life were spent in the house of Sir Francis Masham (whose son Samuel married Abigail Hill, the favourite of Queen Anne), he being Commissioner of Appeals. He died peacefully on October 28th, 1704.

This short sketch, taken mainly from the biography which Quick has prefixed to his edition of the 'Thoughts,' will enable us to understand what were the relations of Locke to education, and also the circumstances under which the undoubted classic was written.

Next month we shall analyse Quick's chapter on Locke.

(*To be continued.*)

THE 1893 SCHOLARSHIP EXAMINATION.

BY DR. GEORGE BEACH, M.A.

Co-Author of a "Manual of our Mother Tongue," "A Girls' Arithmetic," Author of "Elements of English," Entertaining Readers, etc.

1. The great conflict of July is drawing near, and the preliminary skirmishes of May are close at hand. In order to facilitate operations by our militant readers we append a table of selected dates when they may try conclusions with the Science and Art Department. We heartily wish success to them all.

In order to save space in another part of our issue we insert details respecting other events which do not necessarily concern Scholarship Candidates.

Subject.	Date.	Time.
1. Practical Plane and Solid Geometry.	29th April	6 —10 p.m.
2. Model Drawing—Subject 3*a* (Elementary).	1st May	7 — 8 ,,
3. Freehand Drawing of Ornament—Subject 2*b* (Elementary).	1st ,,	8.30—10 ,,
4. Drawing in Light and Shade—Subject 5*b* (Elementary).	2nd ,,	7 — 8.30 ,,
5. Model Drawing—Subject 5*a* (Advanced).	3rd ,,	7 — 9.30 ,,
6. Theoretical Mechanics—Solids	4th ,,	7 —10 ,,
7. Freehand Drawing of Ornament—Subject 3*b* (Advanced).	4th ,,	7 — 9.30 ,,
8. Theoretical Mechanics—Fluids	5th ,,	7 —10 ,,
9. Principles of Ornament—Subject 22 (Elementary and Advanced).	6th ,,	7 —10 ,,
10. Perspective—Subjects 1*c* and 1*e* (Elementary and Advanced).	8th ,,	6 —10 ,,
11. Physiography - - -	8th ,,	7 —10 ,,
12. Agriculture - - - -	9th ,,	7 —10 ,,
13. Mathematics—Stages 1, 2, 3	10th ,,	7 —10.30 ,,
14. Magnetism and Electricity -	11th ,,	7 —10 ,,
15. Sound, Light, and Heat (Elementary).	12th ,,	7 —10 ,,
16. Sound (Advanced and Honours)	12th ,,	7 —10 ,,
17. Practical Inorganic Chemistry (Elementary).	13th ,,	6 — 9.30 ,,
18. Hygiene - - - -	16th ,,	7 —10 ,,
19. Organic Chemistry - -	17th ,,	7 —10 ,,
20. Inorganic Chemistry - -	18th ,,	7 —10 ,,
21. Practical Organic Chemistry (Elementary).	29th ,,	6 — 9.30 ,,
22. Practical Organic Chemistry (Advanced).	29th ,,	6 —10.30 ,,
23. Practical Organic Chemistry (Honours).	29th ,,	2.30—10.30 ,,
		7 —10 ,,
24. Light (Advanced and Honours)	30th ,,	7 —10 ,,
25. Heat (Advanced and Honours)	31st ,,	
26. Botany - - - - -	1st June	7 —10 ,,
27. Practical Inorganic Chemistry (Advanced).	3rd ,,	6 —10.30 ,,
28. Practical Inorganic Chemistry (Honours).	3rd ,,	2.30—10.30 ,,

2. IMPORTANT ALTERATION.—The Code states in the Pupil-Teacher Schedule and with respect to the Scholarship Examination that extra marks will be given for Freehand, Geometry, and Perspective Drawing, but *Model* is not mentioned. As the following official letter will show, the last subject (*Model*) is now included also, provided that a first-class be obtained:—

Department of Science and Art,
SIR, London, S.W., 1st March, 1893.

With reference to your letter received on the 18th ultimo, I am directed to state, in reply to the inquiries therein contained, that (1) pupil-teachers obtaining first-class in second grade model drawing at the examination in drawing of their school in April next.

will be credited with marks for such success at the following scholarship examination; (2) the time allowed for working the examination paper in model drawing is one hour; (3) the examination in perspective at the drawing examination of the above school in April next will be according to the old requirements, *i.e.*, one problem to be worked from three problems set; and (4) one and a half hours is the time allowed for the examination in perspective at elementary schools.

I am,
Yours, &c.
A. J. R. TUNDELL.

WEEK ENDING 8TH APRIL, 1893.

HOLIDAY.

WEEK ENDING 15TH APRIL, 1893.

1. Distinguish particularly between the uses of *shall* and *will*.

2. Analyse the following lines and parse the words in italics:—

"*Believe* not *what* the landsmen say,
Who tempt with doubts *thy* constant *mind*,
They *tell* thee 'Sailors, *when away*,
In every port a *mistress* find.'
Yes! Yes! believe *them* when they *tell* thee so
For thou art *present wherese'er* I go."—*Gay*.

3. Draw a map of the United States, marking in the productions and occupations.

4. Mention the highest peak, the longest river, the largest lake, the largest county, and the most populous city in England, Scotland, and Ireland respectively.

5. What incidents are connected with Hereward, Peter the Hermit, Strongbow, Gaveston, Hotspur, and Hampden?

6. Mention the chief poets and novelists of the Victorian age.

7. Write Notes of a Lesson to Standard VII. on the properties of the circle.

8. Give rules to be attended to at a Writing lesson.

9. Explain what is meant by the diatonic scale. Write it out both in the major and minor form in the key of D. *Or*

(*Tonic-Solfa.*) When we pass from the Doh to the Fah key, what do **s, l, r, m, t, d,** become respectively?

10. Prove the rule for finding the Discount of a given sum for a given time at a given rate per cent.

11. (*Men only.*) How many bricks, each 12 ins. long, 4 ins. wide, and 3 ins. thick, will be required to build a wall 18 ft. 8 ins. long, 12 ft. 6 ins. high, and 9 ins. thick, leaving in it a doorway 6 ft. 3 ins. high, and 2 ft. 8 ins. wide. Ans. 1950.

(*Women only.*) The price of 2 turkeys and 9 fowls is £3, and the price of 5 turkeys and 3 fowls is £4 5s. Find the price of a turkey and a fowl. Ans. 15s. 0d.; 3s. 4d.

12. (*Men only.*) Write out Euclid I. 28.

If from a point without a parallelogram lines be drawn to the extremities of two adjacent sides, and of the diagonal which they include; of the triangles thus formed, that, whose base is the diagonal, is equal to the sum of the other two.

(*Women only.*) State any secure investments for the savings of a wage-earning man; describe the particulars of such investments, and show wherein the safety consists.

13. (*Men only.*) Write out Euclid II. 10.

Show how to produce a given line, so that the rectangle contained by the whole line thus produced and the produced part shall be equal to the square on the part produced.

(*Women only.*) Describe the special properties of milk, and show its adaptation to the very young.

14. (*Men only.*) The breadth of an oblong space is 4 yards less than its length, whilst its area is 252 square yards. Find the length of the sides. Ans. 18 yards × 14 yards.

(*Women only.*) A rate of 1½*d.* in the £ is required to raise a sum of £525 12s. 6d. What is the ratable value of the town?
Ans. £84,100.

15. If $a+b+c=o$, show that $a^4+b^4+c^4=2(ab+bc+ca)^2$.

16. The length of a garden exceeds its breadth by 50 yards; the garden contains 9,375 yards. Find its length and breadth.
Ans. 125 yards, 17 yards.

WEEK ENDING 22ND APRIL, 1893.

1. Paraphrase—

"Be wise to-day: 'tis madness to defer;
Next day the fatal precedent will plead;
Thus on, till wisdom is pushed out of life.
Procrastination is the thief of time;
Year after year it steals till all are fled,
And to the mercies of a moment leaves
The vast concerns of an eternal scene.
If not so frequent, would not this be strange?"—*Young*.

2. Classify broadly the irregular verbs.

3. Describe the Great Barrier Reef, the climate of Queensland, and the city of Sydney.

4. What do you know of the Indian Reserve, the Mormons, the Pilgrim Fathers, and "The Public Park"?

5. Arrange in chronological order, giving the names of the victors, the following battles—Ushant, Beachy Head, Poictiers, Steinkirk, Texel, Vimiera, Dogger Bank, Lexington.

6. Write short lives of Anselm and Joan of Arc.

7. Why is dictation of examples in arithmetic to be preferred to setting the sum on a blackboard?

8. What advantages ought to accrue from learning drawing? What faculties are cultivated by it?

9. Explain the following symbols—*p, pp, m, f, ff, cres, dim, fz, ral.*

10. A goods train is 14 miles ahead of an express which travels at the rate of 50 miles an hour. The goods is run into in 35 minutes. Find the rate at which it was travelling.
Ans. 26 miles per hour.

11. (*Men only.*) A cistern which is 8 feet 4 inches long and as deep as it is wide contains 150 cubic feet 900 cubic inches. What would be the expense of lining its bottom with lead at 2s. 5d. per square foot? Ans. £17 4s. 0½d.

(*Women only.*) Find a sum of money such that $5\frac{2}{13}$ of it shall be equal to 7·2 of £5 3s. $9\frac{1}{13}$d. Ans. £7 4s. 11⅔d.

12. (*Men only.*) Write out Euclid I. 30.

Given two points, one on each side of a given straight line, find a point in the lines such that the angle contained by two lines drawn to the given points may be bisected by the given line.

(*Women only.*) What are the symptoms of measles, scarlet fever, and small pox?

13. (*Men only.*) Write out Euclid II. 11.

Give the algebraic formulæ for the propositions of the Second Book.

(*Women only.*) Name the different materials required in washing and getting up the fine and light articles commonly used by a school teacher.

14. (*Men only.*) If 15 trees can be planted on two square chains of ground, how many can be planted on a rectangular area 1,210 yards in length and 2,244 yards in depth? Ans. 42,075 trees.

(*Women only.*) If 24 lb. of wool make 115 yards of cloth 1 yard wide, how much cloth 1¼ yards wide ought 12 ozs. to make?
Ans. 2⅞ yards.

15. Divide $7x^2-\frac{1}{7}$ by $x+\frac{1}{7}$ and find the value of:—

$$\frac{x^2+y^2}{x^2-y^2} \text{ when } x=\frac{a+b}{a-b} \text{ and } y=\frac{a-b}{a+b}.$$

Ans. $7x-1$; $\frac{a^4+6a^2b^2+b^4}{4ab(a^2+b^2)}$.

16. Two trains, A and B, are despatched from opposite termini of a railway at the same time, with speeds of 20 miles and 30 miles per hour respectively. A third train, C, is started after B and three hours later, with a speed of 40 miles an hour. What is the length of the railway if A pass C half-an-hour after passing B?
Ans. 450 miles.

SCHOLARSHIP OR FOURTH YEAR ROUTINE FOR APRIL, 1893.

DAYS	FIRST WEEK			SECOND WEEK			THIRD WEEK			FOURTH WEEK		
	First Hour	Second hour	Third Hour	First Hour	Second Hour	Third Hour	First Hour	Second Hour	Third Hour	First Hour	Second Hour	Third Hour
MONDAY	First Four Rules of Algebra, Proofs, etc. — Theoretical Needlework	History from 1066 to 1199	"De Bello Gallico," *or* "La Jeune Sibérienne"	Algebraic Fractions, with easy Denominators — Ingredients of Food	Dates from 827 to 1066	"De Bello Gallico," *or* "La Jeune Sibérienne"	Algebraic G.C.M. (Theory and Practice) — Rules of Health	Dates from 1066 to 1307	"De Bello Gallico," *or* "La Jeune Sibérienne"	Algebraic Factors — Miscellaneous Arithmetic	Dates from 1307 to 1461	"De Bello Gallico," *or* "La Jeune Sibérienne"
TUESDAY	Revise Definitions, Postulates, Axioms of Euclid I. — Calico Sampler	General Geography of North America	Science, *or* Revision	Deductions upon Euclid, Book I. — Diagram of Chemise	Revise Geography of England	Science, *or* Revision	Deductions upon Euclid, Book II. — Flannel Sampler	General Geography of Australia	Science, *or* Revision	Second Book of Euclid — Calico Sampler	Repetition, Literature, and Penmanship	Science
WEDNESDAY	Cube Root — Square Root	"De Bello Gallico," *or* "La Jeune Sibérienne"	How to teach Reading	Cock Sums	Repetition, Literature, and Penmanship	How to teach Writing	"De Bello Gallico," *or* "La Jeune Sibérienne"	Parsing and Analysis	How to Teach Arithmetic	Stocks	Greek Roots	How to Teach Grammar
THURSDAY	Algebraic Factors — Savings and Investments	History from 1199 to 1307	Parsing and Analysis	Algebraic G.C.M. (Theory and Practice) — Preparation of Food	History from 1307 to 1377	Study Table of English Literature	Algebraic Fractions — Clothing and Washing	History from 1377 to 1461	English Composition	Simple Equations — Miscellaneous Arithmetic	History from 1461 to 1547	Paraphrasing and Dictation
FRIDAY	First Sixteen Propositions of Euclid, Book I. — Flannel Sampler	General Geography of South America	Theory of Proportion	First Seven Propositions of Euclid, Book II. — Calico Sampler	Map of United States	"De Bello Gallico," *or* "La Jeune Sibérienne"	First Thirty-two Propositions of Euclid, Book I. — Diagram of Chemise	General Geography of Polynesia (except Australia)	Stocks	Deductions upon Euclid, Book I. — Flannel Sampler	Map of Australia	Compound Interest
SATURDAY—4 HOURS.	Drawing, *or* Revision	Science, *or* Revision	Examination	Drawing, *or* Revision	Science, *or* Revision	Examination	Drawing, *or* Revision	Science *or* Revision	Examination	Drawing, *or* Revision	Science, *or* Revision	Examination

WEEK ENDING 29TH APRIL, 1893.

1. Analyse the following lines and parse the words in italics :—

" '*Thus* Heaven instructs thy mind : this *trial* o'er
Depart in peace, *resign*, and sin no *more*.'
On sounding *pinions here* the *youth* withdrew,
The sage *stood wondering as* the seraph flew,
Thus *looked* Elisha, *when*, *to mount* on *high*,
His master took the *chariot of* the sky ;
The fiery pomp *ascending* left the view ;
The prophet gazed and wished to follow *too*."—*Parnell.*

2. Paraphrase the preceding lines.

3. Draw a map of South Africa.

4. Describe the great equatorial current. What are Sargasso Seas ?

5. What were the claims, real or pretended, to the throne, of Arthur of Brittany, Perkin Warbeck, Lady Arabella Stuart, the Young Pretender, Earl of March, and Edgar Atheling ?

6. Relate the events immediately precedent and subsequent to the following sieges ?—Bridgewater, 1645 ; Leith, 1560 ; Limerick, 1691 ; Lucknow, 1857–8 ; and Ciudad Rodrigo, 1812.

7. What are the uses and abuses of mere "*Learning by Heart*" ? Where is it essential ?

8. For Manual Training, what exercise would you select ? Why ?

9. Explain the succession of sharp keys, and say how they are derived the one from the other.

10. The L.C.M. of two numbers, whose G.C.M. is 113 is 5,763. One number is 339 ; find the other. Ans. 1,921.

11. If the present worth of £218, due two years hence, is £200, what is the present worth of £1,298, due four years hence, at the same rate ? Ans. £1,100.

12. (*Men only.*) Write out Euclid I. 33.

Prove that the sum of the distances of any point within a triangle from the three angles is greater than half the perimeter of the triangle.

(*Women only.*) Mention any industrial work in which you have been trained, and state the benefit of such training for future life.

13. (*Men only.*) Write out Euclid II. 12.

Produce one side of a scalene triangle, so that the rectangle under it and the produced part may be equal to the difference of the squares on the other two sides.

(*Women only.*) What do you know of School Penny Banks ? How would you manage one ?

14. (*Men only.*) A schoolroom is 60 ft. long, 20 ft. broad, 10 ft. high to the wall-plate, and 16 ft. high to the ridge of the roof. How many children would it contain allowing 80 cubic feet of space for each child ? Ans. 195 children.

(*Women only.*) If 18 men can dig a trench 17 yards long and 2 yards broad in 17 days, working 5 hours per day, how many men will dig a trench 12 yards long and 4 yards broad in 9 days, working 8 hours a day ? Ans. 30 men.

15. Solve (1) $x^2 + 36 = 9x$. Ans. $\frac{a}{3}$ or $-2a$.

(2) $3x^2 + 5ax - 2a^2 = 0$. Ans. $\frac{9 + \sqrt{-63}}{2}$.

16. An avenue is planted with trees 20 ft. apart. If the trees had been planted 15 ft. apart, the cost would have been increased by £5 at 2s. for each tree. Find the length of the avenue.
Ans. 1,500 ft.

SKETCHES OF MODERN EDUCATIONAL REFORMERS.

III.—ROBERT HEDBERT QUICK.

The Chronicler of the Pedagogues.

BY THOMAS CARTWRIGHT, B.A., B.SC. (LOND.).
Author of 'Mental Science and Logic for Teachers.'

OF Tom Hood it was recorded as his greatest triumph and glory that 'he sang the song of the shirt.' In like manner we, who revere Quick, can find no words testifying more eloquently to his undoubted worth than that he told the tale of the schoolmen. Born in 1832, his somewhat delicate constitution caused him to be educated at private schools until he became sufficiently robust to be entered at Harrow under Dr. Butler. Thence he went to Trinity College, Cambridge. His college career finished, we find him working as additional unpaid curate at St. Mark's, Whitechapel ; but a yearning for school-teaching was strong within him, and he resigned his curacy in order to wield the ferule of the pedagogue. Before settling down to work he went to Leipsic, in which place he spent a winter in mastering the German language—an accomplishment which stood him in excellent stead, for it opened the storehouse of German historical pedagogy to him, and obtained for him a mastership at Harrow.

His first essay in the educational arena was a very modest one—he took a mastership in a provincial Grammar School, being paid for his services the magnificent salary of £20 per annum and his dinner. The experience was not happy in other respects—apart from the financial—for, in the last words which he ever wrote, embodied in an article in the 'Educational Review' (U.S.A.) for May, 1891, he says : 'In the last thirty years I have worked with a great variety of men, and I cannot say that I have retained the same feeling of respect for all ; but there is only one man for whom I feel no respect whatever, and this man was the first Head Master under whom I started teaching.' From 1865 to the end of 1867 he was Assistant Master at Cranleigh, and subsequently became Assistant at Harrow. His career as a Master includes the Head Mastership of a Preparatory School at Orme Square, and, later on, at Guildford.

Like all enthusiasts, he counted on 'setting the Thames on fire,' and, in common with most of his fellows, he had his disappointments. 'I must frankly confess,' says he, 'that I have not succeeded in bringing about results at all answering to my early dreams. Some of my projected improvements I have never been able to carry out ; others which I have carried out, have not made the difference I expected. I ran against many unforeseen difficulties, some of which might have been avoided had I been properly prepared for my work itself.' That he was successful beyond his own belief is proved by the chorus of praise in which all who came in contact with him joined. Like Pestalozzi he was wonderfully fond of children, as the following anecdote by Dr. Butler, then Head Master of Harrow, will prove. 'Two young children at Harrow had caught a mouse in a trap, which the servants naturally wished to destroy ; but the children determined to save their prize, and the happy thought occurred to them of committing the mouse to the tender mercies of "the

kindest man in Harrow." But who was he? Very little cogitation resulted in an unanimous verdict in favour of "Mr. Quick," and in Mr. Quick's drawing-room their little prisoner was let loose, and the children were firm in their belief that the future of their *protégé* was assured.'

Eloquent testimony to his worth is also given by the editor of the 'American Educational Review,' with whom Quick had, just prior to his death, engaged to tell the story of his career. Unhappily the issue containing the first instalment of this professional autobiography contained also the announcement of the author's death. 'Mr. Quick wrote the history, not the annals, of education. He was an educational enthusiast in the best sense. Of all that was formal, cold-blooded and money-making in education he was the inveterate foe. His love for children and for the study of the growing mind imparted intense reality to every word that he wrote on educational practice.' For the two Arnolds he had a profound respect. With Matthew he had a somewhat intimate acquaintance. We can readily conjecture that these two educational enthusiasts would find much to admire in each other. Tennyson, Wordsworth, Carlyle, Newman, and Matthew Arnold were the English writers to whom he was most indebted, in proof of which it is only necessary to glance through his works.

In 1868 he wrote his 'Essays on Educational Reformers,' a book which is increasing in popularity by leaps and bounds. He tells us that he could get no publisher to undertake the publication of the book, and that he brought it out at his own expense. In England the book fell flat; but in America it became so popular as to call for several reprints—a fact which was very complimentary to Mr. Quick, but which 'brought no grist to his mill' in consequence of the non-existence of an international copyright law. Still Quick frankly confesses that the Americans kept his book alive, with such good results that when, in 1890, he published a revised edition, more copies were sold in six months than had been sold in the preceding twenty years. Although he wrote several books and many articles, it is in his 'Reformers' that he 'lives and has his being.' To put into delectable form the pedagogic wisdom of 400 years—to give the essence of this wisdom in language which is charmingly simple and expressive, is no mean feat; and wherever Educational Reformers may be chronicled, he who wrote their history, and was, in addition, one of the most earnest of reformers himself, will certainly not now be forgotten.

In 1883 Quick was appointed Vicar of Sedbergh by the Master and Fellows of Trinity College. After a few years' work he resigned this appointment, in order to devote himself to pedagogics, and the latter part of his life was spent in retirement at Redhill, Surrey.

The establishment of an examination for teachers by the Cambridge University, the first taking place in June, 1880, was hailed with delight by Quick, and it was meet and fitting that he should be chosen to give the first series of Lectures to the students. His subject was, naturally, the 'History of Education,' and he succeeded in infusing his spirit into his hearers just as he had done with his colleagues at Harrow, one of whom thus bears tribute to his efforts in this direction:—'One and another of his colleagues who were new to their work owed it to him that they came to look at schoolmastering with wide open eyes and wider interest. He was always ready and delighted to discuss over his pipe the details and the principles of his profession; and his humour, never in the least unkind, and an endless fund of stories, which he told capitally, made him the most interesting and delightful of companions.'

The appointment of Joseph Payne as the first Professor of Education to the College of Preceptors was another sign of the growing attention to education which was as balm in Gilead to the soul of Quick. Payne, indeed, was one of his most cherished friends, and he quotes the summing-up of Pestalozzi's aims by Payne, in comparison with Morf's views on the same subject. Payne, for his part, fully appreciated Quick, and, upon his death, he left his library to the latter as a proof of his attachment and admiration. Payne's confidence was not misplaced, for most lovingly did Quick garner his treasures, adding to them from time to time, until Earlswood Cottage — his home at Redhill—was packed with books, mostly on education, for he religiously purchased every new book on this subject which was published. His greatest treasures were first editions of Mulcaster, Elyot, and Comenius. Any work on pedagogics could always rely upon Quick as a reader; in fact, he was so completely and entirely given over to the cult of this unjustly-belittled branch of philosophy, that his friends had to go to heredity to explain why this was. His mother, we are told, took great interest in infant school teaching, and had, in fact, anticipated the introduction of the Kindergarten into English schools by causing the village school with which she was connected to be conducted on Fröbelian lines. His father was a business man of strong literary proclivities, and, consequently, our reformer was bound to be literary and also educational, which fully explains the excellence of his work. Be this as it may, no one will impugn the veracity of the following tribute which appeared in the 'Journal of Education,' on April 1st, 1891:—'We have lost one who never spoke or acted save as was noble in the eyes of men. . . . Removed in his sixtieth year, his chief title to the regard of the world rests on his "Educational Reformers"; and it seems that when he had seen that book in its new form, his mature judgment having revised the work of his eager youth, then his mission among us was over.'

Whilst on a visit to Prof. Seeley at Cambridge, being seized with paralysis whilst out for a walk, he died on March 9th, 1891.

What does he teach us? This would require volumes to relate. Like Pestalozzi and Froebel, he was the apostle of Realism. 'Things, not words,' is his cry, and if the better part of his work lay in the domain of theory rather than practice, our debt is still as great, for he has done much to show the reality of a science of education; and by systematising the views and work of the giants among pedagogues, he has fairly earned his title to a niche in the Valhalla of schoolmasters. No one has so eloquently pointed out the fatuity of training the verbal memory; no one has more trenchantly inveighed against the absurdity of the old Grammar School curriculum; no one has claimed more dignity for the teacher's work, and no one has gone so near having his claims allowed.

On the other hand, he has cried out loudly that the teacher must be worthy; that by training and self-effort he must rise to the occasion, and become worthy

of the great work which he has to perform. He is never tired of reiterating Montaigne's aphorism : ''Tis not a soul, 'tis not a body, that we are training up ; but a *man*, and we ought not to divide him.' The case for development, as opposed to cramming, could not be put better than in the following words, taken from his conclusion to his 'Reformers' :—'The study of nature shows us that every animal comes into the world with certain faculties or capabilities. There are a set of circumstances which will develop these capabilities and make the most of them. There are other circumstances which would impede this development, decrease it, or even prevent it altogether. All other animals have this development secured for them by their ordinary environment ; but man, with far higher capacities and with immeasurably greater faculties both for good and for evil, is left far more to his own resources than the other animals. Placed in almost an endless variety of circumstances, we have to ascertain how the development of our offspring may be brought about. We have to consider what are the inborn faculties of our children, and also what aids and what hinders their development. When we have arrived at this knowledge we must educate them by placing them in the best circumstances in our power, and then superintending, judiciously and lovingly, the development of their faculties and of their higher nature.'

This is the way in which he speaks of the elementary schools in the days of payment by results :—'In these schools the heart and the affections are not thought of, the powers of neither mind nor body are developed by exercise, and the children do not acquire any interest that will raise or benefit them.' And again: 'We have never supposed the object of the school to be the development of the faculties of heart, of head, of hand, but we have thought of nothing but learning—learning, first of all, to read, write, and cipher, and then, in " good " schools, one or more extra subjects may be taken up, and a grant obtained for them. The sole object both of managers and teachers is to prepare for the Inspector, who comes once a year, and from an examination of five hours or so pronounces on what the children have learnt.'

The engineer most concerned in the construction of this machine, the Right Hon. Robert Lowe, announced that there could be 'no such thing as a science of education,' and as we had no opinion of our own we took his word for it. But what if confident Mr. Lowe was mistaken ? What if there is such a science, and the aim of it is that children should grow up not so much to *know* something as to *be* something ? In this case we shall be obliged to give up Mr. Lowe and to come round to Pestalozzi. This is just what we are doing—slowly, it is true, as befits the nation which maintained the system of measuring by passes (in spite of the remonstrances of all interested in *education*) for nearly thirty years. The latest circular on infant school instruction is a very hopeful sign that a better state of affairs is imminent, but the retention of 'Fair, Good, and Excellent,' in Infant Schools, as marks of merit shown in examination is worthy of the worst traditions of that Circumlocution Office—the Education Department. So that Quick is undoubtedly right in saying that the progress is slow.

The pupil-teacher system comes in for just censure. 'When I think of the pupil-teacher, with his forty pupils to keep in order, I heartily pity both him and them.' Into which pity most profoundly can we enter.

On the vexed question of the curriculum Quick is sound, as in other matters. Science should certainly be taught. Manual training is ardently praised, and Drawing is a necessity from the first. As to Grammar, he rightly recommends the method of discovery, by which method alone can the subject be made to lose its innate repulsiveness. 'As Prof. Seeley has so well said, they bring to school the knowledge of language in its concrete form. They may soon be taught to observe the language they know already, and to find out for themselves some of the main divisions of words for it.' Again, as to History he says :—'Many schoolmasters will shudder at the thought of a child spending a year or two at school without ever hearing of the Heptarchy or Magna Charta, and without knowing the names of the great towns in Europe. I confess I regard this ignorance with great equanimity.'

Little more need be added in support of our reformer's claims. He himself has said, 'The duty of each generation is to gather up its inheritance from the past, and thus to serve the present, and prepare better things for the future,' which exactly describes what he did for his generation. His edition of Locke's 'Thoughts Concerning Education' was published in 1880, at which time there was no English edition of the work in print, notwithstanding Locke's reputation as a philosopher. From this low ebb the flow of English pedagogic thought has been brought mainly by the efforts of Robert Hedbert Quick, who, being dead, yet speaketh in the many-tongued 'Reformers,' and if any disciple of the New Education has not devoured this epoch-making book, let him proceed to the doing thereof at once. As for a memorial of his work and influence, we may, with our hands on the 'Reformers,' quote the hackneyed but expressive saw, '*Si monumentum quaeris, circumspice*,' and with unfaltering faith pass on our reformer's name to the increasing respect and admiration of that great body of influential and scientific pedagogues, which posterity, in the not far distant future, will see ; in the which fervent belief we put on one side our pen.

ELEMENTARY LESSONS IN HORTICULTURE.

BY PROFESSOR J. R. GREEN, M.A.,
Examiner in Botany to the University of Cambridge, and
F. L. GREEN,
Late Science Mistress in the Clifton High School.

II.—The Root and its Functions ; Layering and Cuttings.

We have seen in our study of the germination of the seed that the embryo contains an axis, at the one end of which is a rudimentary root, or *radicle*, pointing towards the micropyle, and at the other a rudimentary stem, or *plumule*. Under the influences of warmth, air and moisture, the radicle becomes elongated, and emerging from the seed, bends downward into the soil and forms the descending axis of the plant.

The question at once suggests itself, 'What is the cause of this downward direction of the root ?' That it is not a merely accidental phenomenon may easily

be proved by inverting the position of root and shoot, and supplying the plant with water, containing the food-materials necessary for its growth. The axes will be found to curve till they come to occupy again their normal position with regard to the vertical. Neither does the phenomenon depend on the agency of light, for it occurs both in darkness and in light.

When germinating seeds are attached to the edge of a wheel that rotates slowly round a horizontal axis, the radicle does not grow downwards, nor does the plumule grow in an upward direction, but in virtue of the tendency to grow in a straight line, inherent in organs, both radicle and plumule tend to grow straight in any direction in which the seedling may have been placed when attached to the wheel. Now by the slow rotation of the seedling on such a wheel the effect of the action of gravity is eliminated. It follows that the downward direction of the root and the upward direction of the shoot are the response of the growing organs to the stimulating action of gravity. While the primary root, under the influence of gravity, grows vertically downwards, the effect of gravity on lateral or side roots is to make them grow downwards in an oblique direction. Organs which, like the primary root, grow towards the centre of the earth, are called *geotropic;* organs which, like the primary stem, grow away from the centre of the earth, are called *apogeotropic*.

A root may be defined as an outgrowth of the substance of the plant, developed endogenously, destitute of leaves, and clothed at its growing point with a root-cap, or thimble-like sheath of layers of flattened cells, covering the growing point and protecting it from injury. In most dicotyledonous plants the radicle forms the main root of the plant, becomes thickened, and is then known as a *tap-root*. From this *primary* root in such cases spring thinner *secondary* roots. In the case of grasses, asparagus, and other monocotyledonous plants, the primary root that is developed shortly dies, and the plant is fixed in the ground by means of fibrous roots called *adventitious* roots, because they do not result from the direct prolongation of the radicle of the embryo. We shall see presently that the power of a plant to produce adventitious roots is of considerable importance in the work of propagation.

Let us examine more minutely the structure of a tap-root. An excellent example of this kind of root is furnished by the vegetable garden in the case of a young bean plant. From the outside there may be carefully stripped off a thin skin, or *epidermis*, which, when placed under the microscope, will be seen to consist of a single layer of flattened cells, though to the naked eye it presents the appearance of a homogeneous membrane. On certain parts of this when quite young, and on its branches when it has put any out, are delicate *root-hairs*, each of which is formed of a single cell, that may be seen growing out from the epidermis. These have, as we shall see presently in our examination of the functions of the root, an important part to play in the economy of the plant. If we now make a cross section through our root, there will be disclosed a thick band situated directly inside the epidermis, and a darker central portion. These two parts are known respectively as the *cortex* and the *vascular cylinder*. The cortex consists chiefly of the cell tissue called *parenchyma*, which is made up of many-sided cells that are nearly equal in length, breadth, and thickness. The cell-walls are composed of a substance known as *cellulose*, and, within these cell-walls, *protoplasm*, with a *nucleus* embedded in it, is present. The central cavity, or *vacuole*, contains *cell-sap*, the pressure exerted by this fluid having the effect of keeping the protoplasm, or living matter, in contact with the cell-wall. The vascular cylinder is composed not only of cells, but of tubular structures derived from cells, called *vessels*, but its microscopical structure is too complex to admit of more than a brief allusion to it here.

On again examining our root, we cannot fail to see numerous fibres projecting from the main axis. They are secondary roots, so called because they are given off by the main or primary root. Cross sections made through them show that in their structure they resemble the primary root of the plant. If we look carefully at transverse sections of the main root, we shall be able in some to trace the secondary roots as yellow streaks through the cortex to the vascular cylinder. Their origin may readily be seen by a simple experiment. Let us peel off the cortex from a dried carrot. The secondary roots will remain behind, attached to the vascular cylinder, and must therefore originate in the internal tissue, subsequently making their way through the cortex to the exterior. This mode of origin is called *endogenous*. It is characteristic of all roots.

It is a matter of common observation that roots increase both in length and thickness, processes to which we give the name of *growth*. To take first the increase of the root in length, by cutting successive cross sections we shall see that the epidermis, cortex, and vascular cylinder gradually become more and more indistinct in appearance as we approach the end of the root. Ultimately, at the apex of the root, they merge into a minute mass of small cells constituting the *growing point*. There, new cells are constantly being formed by the process of division, and the cells which are nearest the older parts of the root undergo alterations in their size and shape, ultimately becoming mature cells of the epidermis, etc. This growth in length would force the delicate cells of the growing part against hard particles of earth, and result in their injury, or destruction, if it were not for the protection afforded them by the *root-cap*, or sheath that surrounds them. As the outer layers of the root-cap are worn away, new inner layers are added by the growing point. The increase of roots in thickness is brought about by a *cambium layer* situated inside the vascular cylinder, and composed of cells which differ from those of the growing point chiefly in their elongated shape.

Primary roots, we have seen, are so called because they are the direct prolongation of the radicle or embryo root, of a germinating seed. All other roots, originating either from the interior of primary or secondary roots, are called secondary roots, the primary root with its secondary roots, or any root with its lateral roots, being known as a *root system*. We may notice here that in grasses the first root, which as we have said, soon dies, its place being taken by fibrous adventitious roots, arises so deep in the interior of the substance of the embryo that it is covered in the fully-developed embryo of the ripe seed by a thick layer of tissue, which is ruptured on germination, and is known as the *root-sheath*. The root-sheath must be carefully distinguished from the root-cap. The branches of a root are developed in regular order, the

youngest being nearest the growing point—*i.e.*, they arise in *acropetal succession*.

Adventitious roots are not subject to the rule of acropetal succession. They generally spring from a *rhizome*, or creeping underground stem, as in the mint, iris, and primrose, or from a *bulb* or stem whose internodes (spaces between the points from which leaves are given off), are suppressed, as in the tulip and hyacinth. Sometimes, as in the ivy, they arise from the above-ground portion of the stem, and serve the plant for the purpose of climbing. In the case of ferns, adventitious roots spring from the stalks, or base of the fronds.

The horticultural processes of layering and taking cuttings depend on this power of the plant to produce adventitious roots. The process of layering may be readily seen in the case of the clematis, carnations, and picotees. The surface soil should be first removed and replaced with a compost of fine loam, leaf-mould, and sand, so that the young roots may readily strike down into the soil and have a good store of easily available food. A notch should then be made in the branch that is to be layered with a sharp knife, and the layer pegged down into the fine soil. Care is needed in slitting the joint, for the shoots are easily broken. The knife should be inserted about half an inch below the third or fourth joint, sloping the cut toward the joint, and the notch should not be more than half way through at the joint. A little silver-sand should be placed round the cut to secure ready drainage, and it should be covered with about half an inch of fine soil. Layering generally takes place in July, and by the end of September the layers should be well rooted. The usual modes of propagating soft-wooded or herbaceous plants are by seeds and cuttings. In the case of pinks, they are called *pipings*. Geraniums, verbenas, calceolarias, pansies—in a word, the great majority of our bedding plants, are raised in this way. Healthy shoots, neither too old nor too watery in their substance, should be cut through with a sharp knife at the third or fourth joint, and the lower leaves stripped off, in order that the shoots may be firmly inserted in the soil, and that transpiration, the giving off of watery vapour into the air, may be checked, for, if uncounteracted, transpiration makes a plant flag. The cuttings should then be inserted in fine soil and watered. Sometimes cuttings are inserted singly into small 'sixty' pots; sometimes they are placed in rows, in boxes, or in the open ground; very often they are inserted round the edge of pots. Care must be taken not to overwater them, or they will rot away, for a reason that will be explained later. When this happens, they are said to 'damp off.' In the case of plants that require protection during the winter, it is a good plan to take cuttings as early as August, so that they may become well established before they are removed indoors. Many cuttings are taken in the spring from old plants that in a gentle heat 'break,' or throw out young shoots. So easily is a common greenhouse plant, the begonia, produced from cuttings, that when the leaf is inserted in fine soil, roots will grow from its base.

Though the stem usually only sends forth roots when it is covered by or rests on the soil, roots are in some cases produced in the open air. They are then called *aerial* roots. In some instances, as in the indian corn, screwpine and banyan, though originating in the open air, they descend to the ground and become established in the soil, fulfilling the functions of ordinary roots. The lower nodes of indian corn give forth roots which grow to the length of several inches before they reach the ground into which they penetrate. In the screwpine, roots strike down into the soil from the trunk, while in the banyan tree roots from the horizontal branches of the tree establish themselves in the ground, becoming accessory trunks. In the ivy, the aerial rootlets serve for climbing, burying themselves in the bark of trees, and in the crevices of walls.

In the orchids we find many examples of *epiphytes*—*i.e.*, plants that grow on other plants without deriving nourishment from them. In orchids, the aerial root is covered by a membrane, called the *velamen*, which consists of several layers of cells containing air, the irregularly thickened walls being perforated. The velamen appears to serve the important purpose of condensing watery vapour, which thus becomes available for absorption.

Parasites are plants that not only live and grow on other plants, but derive their nourishment from them. The plants on which they grow are called their *hosts*. A familiar example is the mistletoe, a parasite on the oak and other forest trees. The roots of parasites penetrate the tissues of their hosts and fuse with them.

Passing now to the functions of the root, we first of all see in it an organ of support. It is often strongly fixed in the soil by numerous branches, and the nature of its vascular cylinder lends it firmness. The older parts of the roots shorten, thus anchoring it very firmly in the ground and preventing its being raised from the earth by the growth of the stem. These properties of the root render it a very efficient organ of support. The phenomenon of root shortening may readily be observed by sowing some carrot seed, and noticing the behaviour of the seedlings. The seedling shoot at first rises very considerably above the surface of the earth; but after a few days the part of the seedling shoot beneath the cotyledons is quite sunk into the earth, so that the primary leaves lie on the surface of the soil. This change is effected by the under part of the tap-root, which is fast anchored in the ground by the root-hairs, shortening in the ground and drawing the stem of the seedling into the earth. The shortening of the root explains how it is that plants with leaf rosettes, like the daisy and the dandelion, remain close to the surface of the earth, instead of becoming gradually lifted up. Several shoots spring from the upper part of the strong, fleshy tap-root, and grow slowly upwards; but the tap-root, continuing to creep in the soil, draws down the shoots just as deep as they have become elongated above. Roots have consequently been said to burrow in the earth, their anterior part becoming pushed in forcibly between the particles of earth, while the posterior becomes drawn after it by shortening.

The fundamental importance of the root to the plant is that on the root are borne the organs whose function is the absorption of the food materials contained in the soil—viz., the root-hairs. In appearance they are exceedingly delicate-walled narrow tubes, which grow forth from the surface of the roots in very large numbers on the recently-developed parts, and die off after a few days. It is only the young but completely elongated portion of the root that is covered with

vigorous root-hairs. As the root grows longer, the hairs die off its posterior part, and as new ones arise behind the growing apex, the part of the root provided with root-hairs moves forward, coming in contact with particles of soil that have hitherto remained untouched. If we carefully lift a growing carrot, or other strongly-growing plant from the loose earth, we shall see that while the growing end of the root is quite smooth and clean, and the particles of earth readily fall away from the part of the root from which the root-hairs have died off, on the tract still beset with root-hairs the particles of earth are so strongly adherent that they cannot be shaken off. This intimate adherence of the earth particles to the root-hairs is of the utmost importance in the nutrition of the plant.

In considering the root as an organ of absorption, we must distinguish four classes of roots—land roots, water roots, air roots, and parasitic roots. The roots of parasitic plants, we have noticed, penetrate the tissues of their hosts, and from them obtain the supply of water and nutritive substances held in solution in water, which we shall find are essential to the life of the plant. In the case of aerial orchids, the irregularly thickened walls of the velamen are perforated, and in other air plants the cortical parenchyma of the root is loose and spongy, and the epidermal cells are produced into long root-hairs. The roots have thus the power of retaining drops of water that fall on them; and the root-hairs, as we shall see, possess the property of absorbing the mineral substances which are deposited on the surface of the roots in the form of dust, and held in solution in the water. Water roots absorb free water, containing nutritive matter in solution, and also the free oxygen which we shall see presently is required by the root.

To land roots the presence of free water is injurious, for as roots carry on the process of *respiration—i.e.*, they give forth carbon dioxide and absorb free oxygen—when the air present in the interstices between the particles of soil, which normally enters the plant dissolved in the cell sap, is prevented from entering the plant by the interstices becoming completely filled with water, the respiration of the root is checked, since, unlike a water root, it cannot utilize oxygen dissolved in water. Consequently it rots away. Water, to be of service to land roots, must be in what is called a *hygroscopic* condition. By this we mean that it exists in the form of thin films surrounding the moist particles of earth. It is, therefore, one of the most elementary rules of horticulture to let the soil, whether in pots or in the open air, become dry before fresh water is poured on, land plants rooted in flower pots being especially liable to decay at the root from the effects of over watering.

It is by the intimate contact of the root-hairs with the particles of soil that they are able to suck up into the plant the extremely thin layers of water which surround the earth particles. In these films are contained in solution certain food materials essential to the plant's life, such as sulphates of magnesia and lime. A number of very valuable nutritive materials are, however, absorbed by the soil, being held so fast in the soil as to be incapable of being washed out of it by the action of the rain. Such food materials are potash, ammonia, phosphoric acid, and silica. If an ordinary funnel be filled with damp garden soil, and a weak solution of potash salts, phosphates, or ammonia compounds be poured over it and allowed to run through into a receptacle, only slight traces of these materials will be found in the resulting liquid. Chemical compounds of potash, ammonia, and phosphoric acid form, however, extremely fine coats on the surfaces of the small particles of soil. Now the very thin membrane of the root-hair has been found to be permeated with an acid fluid, which has the power of dissolving these substances that are insoluble in water. They are then absorbed by the root-hairs for the use of the plant. It has been proved also by experiment, that the acid fluid of the root-hairs will dissolve even solid minerals, a complete representation of the root system of beans, garden nasturtiums, and other plants having been obtained by the corrosion of the surface of marble plates, to which their roots attached themselves in the process of growth. The root is thus seen, through the medium of its root-hairs, to contribute to the chemical decomposition of the solid particles of stone that occur in soil. The activity of the root in the work of absorption is partially dependent on conditions of temperature; an increase of temperature in the soil up to 25 deg. to 30 deg. C. promoting a more vigorous absorption, as may be seen by a simple experiment, the plant exuding drops of water at the edges of the leaves on the roots being gently warmed.

The excretion of drops of water just referred to is the result of the phenomenon known as *root pressure*, another manifestation of which is found in what is called the 'bleeding' of plants—*i.e.*, the flow of watery fluid that frequently takes place from the cut surface of the portion of the stem which is connected with the root, and from the cut surface of a root that is in connection with the soil by means of root-hairs. This pushing up of the sap into the plant by the roots, known as root pressure, has often a force capable of supporting a column of mercury of no inconsiderable height. It is very easily seen in the case of the vine which, when it is pruned in the spring, exudes water from the large vessels of its cut surfaces. This phenomenon is also very observable in the birch and maple, and herbaceous plants which, like the sunflower, have stout stems and large root systems. The water thus forced up by the roots contains various salts in solution. The relations of root pressure to transpiration will be discussed when we come to investigate the part played in the economy of the plant by the leaves.

An interesting property of roots is their *hydrotropism—i.e.*, the tendency they possess to curve towards moist surfaces when they are brought into their neighbourhood. This tendency may easily be shown by experiment. First, let a few sweet peas, or other large seeds, be sown in damp moss or sawdust in a vessel which is suspended vertically or obliquely, and the bottom of which is perforated with holes of a sufficient size to allow of the passage of the roots of the seedlings through them. In consequence of the attraction of the earth already noticed, the primary roots of the seedlings will grow in a downward direction till they pass through the holes in the bottom of the vessel out into the air. Then the direction of their growth will be seen to undergo a change. Instead of growing vertically downwards as before, they will curve upwards so as to apply themselves to the moist surface, the influence of gravity

having been overcome by the stronger tendency of the roots to curve in the direction of moist surfaces. To prove that it is the dampness of the surface that causes the curvature just noticed, another experiment may be tried. Let the air into which the seedlings escape through the holes in the bottom of the vessel be saturated with moisture. The roots will continue to grow vertically downwards.

In some instances, the root, or portions of it, become thickened and serve as reservoirs of reserve materials for the future use of the plant. To take the common examples of a thickened tap-root afforded by the carrot, beet, radish and turnip, we have huge soft masses of tissue containing sugar, starch, and proteid substances which will be employed at the next period of vegetation, if the roots are left in the ground, for the production of new shoots. The lateral roots, which form fine threads, fulfil the function of absorbing nutritive matter from the soil. In the dahlia and hop, it is the lateral roots that, swelling up, become tuberous masses of reserve food material. In the monk's hood, the napiform tubers are the only part of the plant that persists after the ripening of the fruit, a new plant arising out of each tuber in the next period of vegetation.

To recapitulate: We have seen that—

(i.) The root, as opposed to the shoot, grows in a downward direction, resulting from the action of gravity.

(ii.) A root may be defined as an outgrowth of the substance of the plant, developed endogenously and clothed at its growing point with a root cap.

(iii.) A primary root is the direct downward elongation of the radicle of the embryo. Secondary roots are developed endogenously from primary roots. Adventitious roots do not arise directly or indirectly from the downward elongation of the radicle of the embryo.

(iv.) The structure disclosed by a cross section of a root discloses the epidermis, an outer thin layer of cells, the cortex mainly consisting of ground tissue or parenchyma, and the vascular cylinder from which the secondary roots originate.

(v.) The increase of a root in length is caused by the division of the cells at its apex constituting its growing point. The increase of a root in thickness results from the activity of the cambium layer of its vascular cylinder.

(vi.) Adventitious roots generally spring from a stem either underground, as in the case of bulbs and rhizomes, or above ground, as in the case of aerial roots; but in the case of ferns they spring from the petioles or base of the fronds. The horticultural processes of layering and taking cuttings depend on the power of the plant to produce adventitious roots.

(vii.) The root is an organ of support, firmness being secured to it by its branches, the nature of its vascular cylinder, and its power of shortening.

(viii.) Through its root-hairs the root absorbs moisture and food materials in solution from the films surrounding the particles of soil with which they come into intimate contact. The root-hairs have also the power of absorbing certain substances occurring in the soil which are insoluble in water, but are dissolved by the acid fluid with which the root-hairs are permeated.

(ix.) The phenomenon known as 'the bleeding of plants' results from root pressure, the pushing up of the sap into the plant by the root.

(x.) Roots are hydrotropic—*i.e.*, they possess a tendency to curve in the direction of moist substances when they are brought into their neighbourhood.

(xi.) The root, or a portion of it, occasionally becomes thickened, and serves as a reservoir of reserve materials for the future use of the plant.

(xii.) Occasionally, as in the dahlia and monk's hood, the root serves as an organ of reproduction.

(*To be continued.*)

L'AVARE.

(*Molière.*)

TRANSLATED BY PROFESSOR DARQUÉ.—(*Author of "Pupil Teachers' French Course."*)

L'AVARE.

HARPAGON. Je veux renfermer ce que bon me semble et faire sentinelle comme il me plaît. Ne voilà pas de mes[53] mouchards qui prennent garde à ce qu'on fait! (*Bas, à part.*) Je tremble qu'il n'ait soupçonné quelque chose de mon argent. (*Haut.*) Ne serais-tu point homme à faire courir le bruit que j'ai chez moi de l'argent caché?

LA FLÈCHE. Vous avez de l'argent caché?

HARPAGON. Non, coquin, je ne dis pas cela. (*A part.*) J'enrage. (*Haut.*) Je demande si, malicieusement, tu n'irais[54] point faire courir le bruit que j'en ai?

THE MISER.

HARPAGON. I will lock up whatever seems proper to me, and watch as I please. You are a spy, who are watching what I am doing. (*In a low tone, aside.*) I dread lest he should have suspected something about my money. (*Aloud.*) Are you not capable of spreading the report that I have money hid in my house?

LA FLÈCHE. You have hid some money?

HARPAGON. No, scoundrel, I do not say so. (*Aside.*) I am vexed. (*Aloud.*) I am asking whether you do not go and spread the report that I have?

NOTES.

(53) *Mes mouchards.* The possessive pronoun *mes* does not here allude to possession; it expresses rather the contempt in which Harpagon holds spies.

(54) *Si . . . tu n'irais point faire courir le bruit . . .* would be equally well rendered by "if . . . perchance you do not spread the report . . ."

LA FLÈCHE. Hé ! que nous importe que vous en ayez, ou que vous n'en ayez pas, si c'est pour nous la même chose ?

HARPAGON (*levant la main pour donner un soufflet à La Flèche*). Tu fais le raisonneur ; je te baillerai[55] de ce raisonnement-ci par les oreilles. Sors d'ici, encore une fois.

LA FLÈCHE. Eh bien ! je sors.

HARPAGON. Attends. Ne m'emportes-tu rien ?

LA FLÈCHE. Que vous emporterais-je ?

HARPAGON. Viens, çà, que je voie. Montre-moi tes mains.

LA FLÈCHE. Les voilà.

HARPAGON. Les autres.[56]

LA FLÈCHE. Les autres ?

HARPAGON. Oui.

LA FLÈCHE. Les voilà.

HARPAGON (*montrant les hauts-de-chausses[57] de La Flèche*). N'as-tu rien mis ici dedans ?

LA FLÈCHE. Voyez vous-même.

HARPAGON (*tâtant le bas des chausses de La Flèche*). Ces grands hauts-de-chausses sont propres à devenir les recéleurs des choses qu'on dérobe ; et je voudrais qu'on en eût fait pendre quelqu'un.

LA FLÈCHE (*à part*). Ah ! qu'un[58] homme comme cela mériterait bien ce qu'il craint ! et que j'aurais de joie à le voler !

HARPAGON. Euh ?

LA FLÈCHE. Quoi ?

HARPAGON. Qu'est-ce que tu parles de voler ?

LA FLÈCHE. Je vous dis que vous fouillez bien partout pour voir si je vous ai volé.

HARPAGON. C'est ce que je veux faire.

(*Harpagon fouille dans les poches de La Flèche.*)

LA FLÈCHE (*à part*). La peste soit de l'avarice, et des avaricieux !

HARPAGON. Comment ? que dis-tu ?

LA FLÈCHE. Ce que je dis ?

HARPAGON. Oui ; qu'est-ce que tu dis d'avarice, et d'avaricieux ?

LA FLÈCHE. Je dis que la peste soit de l'avarice, et des avaricieux ?

HARPAGON. De qui veux-tu parler ?

LA FLÈCHE. Des avariceux.

HARPAGON. Et qui sont-ils, ces avaricieux ?

LA FLÈCHE. Des vilains,[59] et des ladres.

HARPAGON. Mais qui est-ce que tu entends par là ?

LA FLÈCHE. De quoi vous mettez-vous en peine ?

HARPAGON. Je me mets en peine de ce qu' il faut.

LA FLÈCHE. Est-ce que[60] vous croyez que je veux parler de vous ?

HARPAGON. Je crois ce que je crois ; mais je veux que tu me dises à qui tu parles quand tu dis cela.

LA FLÈCHE. Je parle . . . je parle à mon bonnet.

LA FLÈCHE. Ha ! What matters it to us whether you have or have not any, if it is for us *one and* the same thing ?

HARPAGON (*raising his hand to give La Flèche a box on the ear*). You want to argue the case with me ; I will give you some of this argument about your ears. Get out, *I tell you* once more.

LA FLÈCHE. Well ! I am going.

HARPAGON. Wait. Are you not taking anything away ?

LA FLÈCHE. What should I rob you of ?

HARPAGON. Come here, that I may see. Show me your hands.

LA FLÈCHE. There they are.

HARPAGON. The others.

LA FLÈCHE. The others ?

HARPAGON. Yes.

LA FLÈCHE. There they are.

HARPAGON (*showing La Flèche's hose*). Have you put nothing inside here ?

LA FLÈCHE. See for yourself.

HARPAGON (*feeling the lower part of La Flèche's hose*). That large hose is well calculated to become the receiver of stolen goods ; and I wish that they had had some of the thieves hanged.

LA FLÈCHE. Oh ! How richly a man like that would deserve what he fears ! And how glad I should be to rob him !

HARPAGON. Ha !

LA FLÈCHE. What ?

HARPAGON. What are you saying about robbing ?

LA FLÈCHE. I say that you are searching well everywhere to see whether I have robbed you.

HARPAGON. That is what I will do.

(*Harpagon searches La Flèche's pockets.*)

LA FLÈCHE. A plague on avarice and misers !

HARPAGON. What ? What are you saying ?

LA FLÈCHE. What am I saying ?

HARPAGON. Yes ; what are you saying about avarice and misers ?

LA FLÈCHE. I say, a plague on avarice and misers.

HARPAGON. Of whom do you mean to speak ?

LA FLÈCHE. Of misers.

HARPAGON. And who are those misers ?

LA FLÈCHE. Curmudgeons and stingy people.

HARPAGON. But whom do you mean thereby ?

LA FLÈCHE. What do you trouble yourself for ?

HARPAGON. I trouble myself for what I should.

LA FLÈCHE. Do you think I mean you ?

HARPAGON. I believe what I believe, but I will have you tell me whom you are speaking to when you say that.

LA FLÈCHE. I speak . . . I speak to my cap.

(55) *Je te baillerai.* We now say *je te donnerai.*

(56) *Les autres ?* Some critics thought this an imperfection in Molière's play, whereas he merely translated Plautus' sentence in his comedy *Aulularia ;* only Molière used the plural, and Plautus the singular.

(57) *Les hauts-de-chausses* used to be called also *le haut-de-chausses,* which latter was the more rational expression.

(58) *Qu'un homme* here stands for *combien un homme.*

(59) *Un vilain* originally meant any person without nobiliary titles ; here, however, it plainly alludes to misers. Notice that the adjective *vilain* may mean either "nasty" or "ugly."

(60) *Est-ce que vous croyez* is more emphatic than *croyez-vous,* though both expressions mean one and the same thing.

HARPAGON. Et moi, je pourrais bien parler à ta barrette.[61]

LA FLÈCHE. M'empêcherez-vous de maudire les avaricieux ?

HARPAGON. Non ; mais je t'empêcherai de jaser, et d'être insolent. Tais-toi.

LA FLÈCHE. Je ne nomme personne.

HARPAGON. Je te rosserai,[62] si tu parles.

LA FLÈCHE. Qui se sent morveux, qu'il se mouche.[63]

HARPAGON. Te tairas-tu ?

LA FLÈCHE. Oui, malgré moi.

HARPAGON. Ha, ha.

LA FLÈCHE (*montrant à Harpagon une des poches de son justaucorps*). Tenez, voilà encore une poche. Etes-vous satisfait ?

HARPAGON. Allons, rends-le-moi sans te fouiller.

LA FLÈCHE. Quoi ?

HARPAGON. Ce que tu m'as pris.

LA FLÈCHE. Je ne vous ai rien pris du tout.

HARPAGON. Assurément ?

LA FLÈCHE. Assurément.

HARPAGON. Adieu. Va-t'en à tous les diables !

LA FLÈCHE, (*à part*). Me voilà fort bien congédié.

HARPAGON. Je te le mets[64] sur ta conscience, au moins.

SCÈNE IV.

HARPAGON.

Voilà un pendard de valet qui m'incommode fort ; et je ne me plais point à voir ce chien de boiteux-là.[65] Certes, ce n'est pas une petite peine que de garder chez soi une grande somme d'argent ; et bienheureux qui a tout son fait bien placé, et ne conserve seulement que[66] ce qu'il faut pour sa dépense. On n'est pas peu embarrassé à inventer, dans toute une maison, une cache fidèle ; car, pour moi, les coffres-forts me sont suspects, et je ne veux jamais m'y[67] fier. Je les tiens justement une franche amorce à voleurs, et c'est toujours la première chose que l'on va attaquer.

SCÈNE V.

HARPAGON, ÉLISE ET CLÉANTE

(*parlant ensemble, et restant dans le fond du théâtre*).

HARPAGON (*se croyant seul*). Cependant je ne sais si j'aurais[68] bien fait d'avoir enterré dans mon jardin dix mille écus qu'on me rendit hier. Dix mille écus en or chez soi est une somme assez . . . (*A part, apercevant Élise et Cléante.*) O ciel! je me serai trahi moi-même. La chaleur m'aura emporté ; et je crois que j'ai parlé haut en raisonnant tout seul. (*A Cléante et à Élise.*) Qu'est-ce ?

HARPAGON. And *I* might possibly speak seriously to you.

LA FLÈCHE. Will you prevent my cursing misers ?

HARPAGON. No, but I shall prevent your chattering and being insolent. Hold your tongue.

LA FLÈCHE. I name no one.

HARPAGON. I shall thrash you if you speak.

LA FLÈCHE. Let him put the cap on whom it fits.

HARPAGON. Will you hold your tongue ?

LA FLÈCHE. Yes, in spite of myself.

HARPAGON. Ha, ha.

LA FLÈCHE (*showing Harpagon one of the pockets of his doublet*). Look, there is another pocket. Are you satisfied ?

HARPAGON. Come, give it me back without my searching you.

LA FLÈCHE. What ?

HARPAGON. What you robbed me of.

LA FLÈCHE. I have not robbed you of anything at all.

HARPAGON. Assuredly ?

LA FLÈCHE. Assuredly.

HARPAGON. Farewell. Go to the devil !

LA FLÈCHE (*aside*). I am very well dismissed.

HARPAGON. I leave it to your conscience, at least.

SCENE IV.

HARPAGON.

That is a rascal of a servant who troubles me very much, and I am not at all pleased to see that lame dog. It certainly is not a little trouble to keep a large sum of money in one's house ; and he is very lucky who has safely invested his money, and keeps only what is needed for his *current* expenses. One is not a little puzzled to find in the whole of a house a safe hiding place ; for, as for me, safes (strong boxes) are suspicious, and I never will trust them. I look upon them as a bait for thieves, and it is always the first thing that is attacked.

SCENE V.

HARPAGON, ÉLISE ET CLÉANTE

(*talking together, and remaining at the back of the stage*).

HARPAGON (*thinking himself alone*). Yet I do not know whether I did right when I buried in my garden ten thousand crowns that were returned to me yesterday. Ten thousand crowns in gold at one's home is a sum sufficiently . . . (*Aside, perceiving Élise and Cléante.*) Oh heavens ! I most likely betrayed myself. My warmth has carried me too far ; and I think that I have spoken aloud while communing with myself. (*To Cléante and Élise.*) What do you want ?

(61) *Barrette* had the same meaning as *bonnet*, but *parler à sa barrette* was synonymous with *parler ferme et de près*, whereas *parler à son bonnet* means *se parler à soi-même.*

(62) *Rosser* originally meant to curry or cleanse (a horse).

(63) *Se moucher*, literally "to blow one's nose."

(64) *Je te le mets sur ta conscience.* Notice the use of both *te* and *ta* for the sake of emphasis ; under ordinary circumstances we would say, *je te le mets sur la conscience.*

(65) *Boiteux.* An allusion to an accidental lameness of the actor who was acting the part of La Flèche.

(66) *Seulement* is equivalent to *ne . . . que ;* this tautology was then intended to lay stress on that adverb.

(67) *Se fier* does not require the preposition *à* before its personal pronoun object when the latter is used in reference to things.

(68) *J'aurai.* We now more often use the present indicative *j'ai.*

CLÉANTE. Rien, mon père.
HARPAGON. Y a-t-il longtemps que vous êtes[69] là ?
ÉLISE. Nous ne venons que d'arriver.[70]
HARPAGON. Vous avez entendu . . .
CLÉANTE. Quoi ? mon père.
HARPAGON. Là . . .
ÉLISE. Quoi ?
HARPAGON. Ce que je viens de dire.
CLÉANTE. Non.
HARPAGON. Si fait, si fait.[71]

ÉLISE. Pardonnez-moi.

CLÉANTE. Nothing, father.
HARPAGON. Have you been there long ?
ÉLISE. We have only just come.

HARPAGON. You have heard . . .
CLÉANTE. What ? father.
HARPAGON. There . . .
ÉLISE. What ?
HARPAGON. What I have just said.

CLÉANTE. No.
HARPAGON. I beg your pardon ; I beg your pardon.
ÉLISE. Pardon me.

(To be continued.)

([69]) *Vous êtes.* The present indicative is required in French, because the person *is* still there, a fact but imperfectly denoted by the perfect tense used in English in that and similar instances.

([70]) *Nous ne venons que d'arriver.* Compare that expression with *nous venons d'arriver*, we have just arrived (come).

([71]) *Si fait* is said to be a contraction of *si, vous l'avez fait*, yes, you have done so. Notice that *si* is used instead of *oui* in answer to a question or an assertion containing a negative: *pleut-il ? oui, Monsieur*, does it rain ? yes, sir ; *ne pleut-il pas ? Si, Monsieur.*

OUR 1893 CERTIFICATE CLASS.

BY DR. GEORGE BEACH, M.A.

Co-Author of "A Manual of our Mother Tongue," "A Girls' Arithmetic." Author of "Elements of English," "Entertaining Readers," etc.

MODEL ANSWERS TO SCHOOL MANAGEMENT.

CERTIFICATE EXAMINATION.

SECOND YEAR (MEN AND WOMEN).

1 (*a*). Give a specimen of a class register, framed for one week's entries, and twelve names.

Admission No.	Age. Y.	Age. M.	Name.	Week Ending July 15th. M.		Tu.		W.		Th.		F.	
				M.	A.	M.	A.	M.	A.	M.	A.	M.	A.
12	7	1	Armstrong, Zephaniah	\	\	\	\	O	\	\	\	\	\
13	7	2	Brown, Albert - -	\	O	O	\	\	\	\	\	\	⑤
110	6	3	Chesters, Benjamin -	\	\	\	\	\	\	\	\	\	\
14	7	4	Dranfield, Charles -	\	\	\	\	O	\	\	\	\	⑥
15	7	5	Evans, David - -	\	\	\	\	O	\	O	\	\	⑧
1	8	6	Fowler, Ernest - -	\	\	\	\	O	\	\	\	\	\
16	7	7	Godwin, Fred. - -	\	\	\	\	\	\	\	\	\	\
17	7	8	Hastings, George -	\	\	\	\	O	\	\	\	\	\
18	7	9	Ireton, Helen - -	\	\	\	\	O	\	\	\	\	\
9	8	10	Jenkins, Isabella -	\	\	\	\	\	\	O	\	\	⑩
19	7	11	Keene, Jemima -	\	\	\	\	\	\	\	O	\	⑪
3	6	12	Lester, Katherine -	\	\	O	\	O	\	\	\	\	\
Total -			Boys	8	7	7	8	3	8	7	8	8	5
			Girls	4	4	3	4	9	4	3	3	4	7
Withdrawals, &c.			Managers' Signature, &c.							7 With. 3		+ 3 + 2	

N.B.—The punctual scholars are denoted by red ink strokes, (not here coloured) the late ones, who came in before closing of registers, by black strokes.

1 (*b*). Quote such brief entries as should be made in the log-book relating to these facts.

1 (*b*). *Log-book*, 13th July. Weather, very stormy this morning, seriously lowered the attendance; no less than 7 being absent. Attendance being so poor this morning, and several parents having notified their wish that their children should be absent to-morrow morning to view "Wombell's Wild Beast Show" (which is entering the town at 11 p.m.), I promised, having consulted the correspondent, to dismiss at that time. This was done to induce the scholars to attend. Although the nominal attendance will somewhat suffer, the children will thus not lose their instruction.

14th July. Pursuant to promise, school was dismissed at 11 p.m. and the attendances cancelled.

15th July. Three boys and two girls absent, attending drawing and cookery lessons respectively at the Technical School for two hours.

1 (*c*). Make out the week's summary.

1 (*c*). SUMMARY REGISTER, WEEK ENDING JULY 15th.

Class.	Attendances. Boys.	Attendances. Girls.	Total Attendances.	Times Open.	Average. Boys.	Average. Girls.	Total Average.	No. on Books.	No. Present during Week.
II.	65	32	97	10	6·5	3·2	9·7	12	12

2. What do you understand by the assertion that Arithmetic is a Science as well as an Art ? Illustrate your answer by showing how you would teach proportion (*a*) in a scientific, and (*b*) in a practical way.

(1) The theory of Arithmetic is Science, the skilful practice of it is Art.

(2) *Scientific Teaching of Proportion* :—

(*a*) Reduction of fractions to their lowest terms should be known so that it is understood that $\frac{3}{4}=\frac{6}{8}$, &c.

(*b*) Define *ratio* and show that it may be expressed by a Vulgar Fraction, and also by the signs "As 3 : 4" or "As 6 : 8." The two terms of a ratio must be of the same kind.

(*c*) Define *proportion* as the equality of ratios. Thus "As 3 : 4 :: 6 : 8."

(*d*) Prove from (*a*) that "*The product of the extreme terms is equal to the product of the mean terms.*" In the example $3 \times 8 = 4 \times 6 = 24$.

(*e*) Show that any one of the four terms may be found if the other three be given ; thus : As 3 : 4 :: 6 : x.

Here the product of the means is $4 \times 6 = 24$. Therefore the product of 3 and x must be 24 ; $\therefore x = 8$.

(*f*) Point out the operations, viz., that "*The second and third terms were multiplied together, and their product divided by the first.*" This gives the fourth term.

(3) *Practical Teaching*:—

Example : If A gives B 3 nuts out of 4, how many will he give B out of 8 ?

(*a*) Something is told, "A gives B 3 nuts out of 4." Something is asked, "How many will A give B out of 8."

(*b*) There are three terms, hence the name "*Rule of three.*" Two of these terms are in the *given* part, one of these in the *requesting* part.

vigorous root-hairs. As the root grows longer, the hairs die off its posterior part, and as new ones arise behind the growing apex, the part of the root provided with root-hairs moves forward, coming in contact with

compounds be poured over it and allowed to run through into a receptacle, only slight traces of these materials will be found in the resulting liquid. Chemical compounds of potash, ammonia and phos-

(*c*) Find the third term first, as it must be of the *same kind* as the answer. It will always be in the given (the two-term) part of the problem. The question requires *nuts given* as answer, then *nuts given*, viz., 3, will be the third term. As : :: : *x*.

(*d*) A gives 3 out of 4, will he give more or less than 3 out of 8? Evidently more.

Then of the terms 4 and 8, the *more*, 8 must be the second term, and the *less* 4, be the first term. As $4 : 8 :: 3 : x$.

(*e*) Apply the rule and obtain $\frac{3 \times 8}{4} = 6$. Answer.

Now show that $\frac{6}{8} = \frac{3}{4}$.

(*f*) Give kindred problems such as:—

(*x*) If A gives B 6 nuts out of 8, how many will he give out of 4?

(*β*) If A gives B 6 nuts out of 8, how many will he have when he gives B 6?

(*γ*) If A gives B 3 nuts out of 4, how many will he have when he gives B 6?

3. If you were at the head of a school with a staff of one certificated assistant, two assistant teachers, and three pupil-teachers, how would you divide the duty between them, and what share of the teaching would you yourself undertake? What should be the average number of scholars in such a school?

The maximum average allowed would be:—

Head teacher - - - - - -	60
Certificated assistant - - - - -	70
2 assistants, 2 × 50 - - - - -	100
3 pupil-teachers, 3 × 30 - - - -	90
	320

In the case given, there are six teachers *with* the Head, and probably the 320 scholars would be distributed as follows:—

Standard I.	65	Scholars	taught by	assistant.
,, II.	60	,,	,,	,,
,, III.	55	,,	,,	elder P.T.
,, IV.	48	,,	,,	junior P.T.
,, V.	40	,,	,,	head master.
,, VI.	35	,,	,,	certificated assistant }
,, VII.	17	,,	,,	,, ,, }

The certificated assistant would take Standards V., VI., and VII. *combined* for such subjects as Singing, Recitation, Drill, Writing in Copy Books, Transcription, Geography, and at times Reading and Dictation, leaving the head teacher free to discharge his peculiar duties.

4. Draw up an examination paper, such as would be suitable for a scholar leaving school at 13, and would properly test his or her knowledge in the three subjects of Arithmetic, English, and Geography *or* History.

In the optional subjects we will take Geography.

(*a*.) *Arithmetic.*—(1) Of an electric cable $\frac{1}{12}$ rests on the bottom of the sea, $\frac{1}{12}$ hangs in the water, and 234$\frac{3}{4}$ yards are employed on land. What is the length of the cable?

Ans.—2691$\frac{1}{2}\frac{3}{4}$ yards.

(2) What is the cost of papering a room 21 feet long, 16$\frac{1}{2}$ feet wide, 10$\frac{1}{2}$ feet high at 6$\frac{1}{2}$d per sq. yard.

Ans.—£2 6s. 3$\frac{3}{4}$d.

(3) A invests £552 in the 3$\frac{1}{2}$ per cents. when they are at 92, B invests £679 in the 3 per cents. when they are at 97. Find the difference in their incomes.

Ans.—£1 10s. 0d.

(4) If 9 men *or* 16 women could do a piece of work in 144 days, in what time would 7 men and 9 women do it working together? Give answer in decimals.

Ans.—107·4404145...days.

(*b*) *English.*—(1) Analyse the following passage and parse the italicised words:—

When I left the *lovely* place *where* I *was born*, I said, "*Oh! that* I *might* live *here for ever*."

(2) Derive the parts of the following words:—

Obstinacy, præternatural, unwisdom, misanthropical, epigram, inward.

(3) What Prepositions follow the appended words:—

Favourable, depend, indifferent, different, angry, satisfied, departed.

(4) Paraphrase:—

I have not tried to hide myself. I am he whom you seek, and to you, I at once give myself up. Deal with me as you like.

Geography.—(1) Where are you? What is your race? What natural privileges do you enjoy? What responsibilities have you to discharge as a member of your nation?

(2) What parts of the world would be best for an emigrant to go to who is an agricultural labourer, *or* an artisan, *or* a capitalist?

(3) What are the chief causes that determine climate?

(4) Show how physical geography has influenced political geography?

5. Write full notes of a lesson on one of the following topics, showing (*a*) for what class of scholars it is intended, (*b*) what visible or other illustration would be required, and (*c*) what is the educational object aimed at:—

(i.) The Savings' Bank;
(ii.) Some simple rules for preserving health;
(iii.) The use of metaphors;
(iv.) Plants used as food (*for an infant class*).

We will take some "simple rules for preserving health" in a lesson to be given to Standard VI. Specimens of clothing fabrics, Diagrams of circulation of blood and of the trunk of the body, and Specimens preserved in alcohol would be required as illustrations.

The educational objects (as distinct from mere knowledge) aimed at, would be the enlightenment of the intellect, the furtherance of the moral faculty, the due adjustment of the social instinct, and the formation of right habits.

NOTES OF LESSON.

(*a*) *What is health?* It is the state of wholeness or soundness of the whole being, a freedom from disease, weakness, and pain.

(*b*) *Perfect health* comprises (*a*) health of body, (*b*) health of mind.

There is a great inter-relationship and inter-action between body and mind. When the mind is ill at ease the body suffers, when the body is diseased the spirits suffer, and the intellect is often darkened.

(*c*) *Preservation of health* demands regular habits and conformity to certain physiological principles. These again presuppose the observance of rules.

(*a*) *Rules for preservation of bodily health.*

(1) Let the *diet* be plain, nourishing, sufficient in quantity, occasionally varied, and regularly partaken of.

(2) Enough time must be devoted to rest, sleep, and exercise at stated times, and excesses of any kind must not be committed.

(3) The clothing must be warm, loose, not too heavy, and adapted to the climate and occupation.

(4) The habitation should be properly ventilated, supplied with pure water, free from damp, well lighted, and fairly comfortable.

(*c*) *Rules for preservation of mental health.*

(1) The mind must be occupied, but not strained or overworked.

(2) A cheerful disposition must be cultivated.

(3) Sufficient diversions must be allowed.

(4) The organs of sense, especially the eyes, should be well-cared for.

(5) Morality must be scrupulously guarded.

6. Write a short essay on the relative values of manual and intellectual training, and show how both ought to be kept in view in the management of a school.

Man is a complex creature, possessing both body and mind, and lives surrounded by a material environment subject to well-designed laws.

To support his body and to advance his species, he must manipulate matter with his hands, and also intellectually appreciate the force of natural laws and principles.

The relative value of manual and intellectual training cannot be accurately determined upon general principles. It must be considered with respect to the individual and his concomitant circumstances.

To a man born to wealth or destined to a sedentary career, intellectual training is of more utilitarian value than manual training. Moreover, each one's idiosyncracy must be studied.

having been overcome by the stronger tendency of the roots to curve in the direction of moist surfaces. To prove that it is the dampness of the surface that causes the curvature just noticed, another experiment

root discloses the epidermis, an outer thin layer of cells, the cortex mainly consisting of ground tissue or parenchyma, and the vascular cylinder from which

LA FLÈCHE. Hé ! que nous importe que vous en ayez, ou que vous n'en ayez pas, si c'est pour nous la même chose ?

HARPAGON (*levant la main pour donner un soufflet à La Flèche*). Tu fais le raisonneur ; je te baillerai [55] de ce raisonnement-ci par les oreilles. Sors d'ici, encore une fois.

LA FLÈCHE. Eh bien ! je sors.

HARPAGON. Attends. Ne m'emportes-tu rien ?

LA FLÈCHE. Que vous emporterais-je ?

HARPAGON. Viens, çà, que je voie. Montre-moi tes mains.

LA FLÈCHE. Les voilà.

HARPAGON. Les autres.[56]

LA FLÈCHE. Les autres ?

HARPAGON. Oui.

LA FLÈCHE. Les voilà.

HARPAGON (*montrant les hauts-de-chausses*[57] *de La Flèche*). N'as-tu rien mis ici dedans ?

LA FLÈCHE. Voyez vous-même.

HARPAGON (*tâtant le bas des chausses de La Flèche*). Ces grands hauts-de-chausses sont propres à devenir les recéleurs des choses qu'on dérobe ; et je voudrais qu'on en eût fait pendre quelqu'un.

LA FLÈCHE (*à part*). Ah ! qu'un [58] homme comme cela mériterait bien ce qu'il craint ! et que j'aurais de joie à le voler !

HARPAGON. Euh ?

LA FLÈCHE. Quoi ?

HARPAGON. Qu'est-ce que tu parles de voler ?

LA FLÈCHE. Je vous dis que vous fouillez bien partout pour voir si je vous ai volé.

HARPAGON. C'est ce que je veux faire.

(*Harpagon fouille dans les poches de La Flèche.*)

LA FLÈCHE (*à part*). La peste soit de l'avarice, et des avaricieux !

HARPAGON. Comment ? que dis-tu ?

LA FLÈCHE. Ce que je dis ?

HARPAGON. Oui ; qu'est-ce que tu dis d'avarice, et d'avaricieux ?

LA FLÈCHE. Je dis que la peste soit de l'avarice, et des avaricieux ?

HARPAGON. De qui veux-tu parler ?

LA FLÈCHE. Des avariceux.

HARPAGON. Et qui sont-ils, ces avaricieux ?

LA FLÈCHE. Des vilains,[59] et des ladres.

HARPAGON. Mais qui est-ce que tu entends par là ?

LA FLÈCHE. De quoi vous mettez-vous en peine ?

HARPAGON. Je me mets en peine de ce qu' il faut.

LA FLÈCHE. Est-ce que [60] vous croyez que je veux parler de vous ?

HARPAGON. Je crois ce que je crois ; mais je veux que tu me dises à qui tu parles quand tu dis cela.

LA FLÈCHE. Je parle . . . je parle à mon bonnet.

LA FLÈCHE. Ha ! What matters it to us whether you have or have not any, if it is for us *one and* the same thing ?

HARPAGON (*raising his hand to give La Flèche a box on the ear*). You want to argue the case with me ; I will give you some of this argument about your ears. Get out, *I tell you* once more.

LA FLÈCHE. Well ! I am going.

HARPAGON. Wait. Are you not taking anything away ?

LA FLÈCHE. What should I rob you of ?

HARPAGON. Come here, that I may see. Show me your hands.

LA FLÈCHE. There they are.

HARPAGON. The others.

LA FLÈCHE. The others ?

HARPAGON. Yes.

LA FLÈCHE. There they are.

HARPAGON (*showing La Flèche's hose*). Have you put nothing inside here ?

LA FLÈCHE. See for yourself.

HARPAGON (*feeling the lower part of La Flèche's hose*). That large hose is well calculated to become the receiver of stolen goods ; and I wish that they had had some of the thieves hanged.

LA FLÈCHE. Oh ! How richly a man like that would deserve what he fears ! And how glad I should be to rob him !

HARPAGON. Ha !

LA FLÈCHE. What ?

HARPAGON. What are you saying about robbing ?

LA FLÈCHE. I say that you are searching well everywhere to see whether I have robbed you.

HARPAGON. That is what I will do.

(*Harpagon searches La Flèche's pockets.*)

LA FLÈCHE. A plague on avarice and misers !

HARPAGON. What ? What are you saying ?

LA FLÈCHE. What am I saying ?

HARPAGON. Yes ; what are you saying about avarice and misers ?

LA FLÈCHE. I say, a plague on avarice and misers.

HARPAGON. Of whom do you mean to speak ?

LA FLÈCHE. Of misers.

HARPAGON. And who are those misers ?

LA FLÈCHE. Curmudgeons and stingy people.

HARPAGON. But whom do you mean thereby ?

LA FLÈCHE. What do you trouble yourself for ?

HARPAGON. I trouble myself for what I should.

LA FLÈCHE. Do you think I mean you ?

HARPAGON. I believe what I believe, but I will have you tell me whom you are speaking to when you say that.

LA FLÈCHE. I speak . . . I speak to my cap.

(55) *Je te baillerai.* We now say *je te donnerai.*

(56) *Les autres ?* Some critics thought this an imperfection in Molière's play, whereas he merely translated Plautus' sentence in his comedy *Aulularia ;* only Molière used the plural, and Plautus the singular.

(57) *Les hauts-de-chausses* used to be called also *le haut-de-chausses*, which latter was the more rational expression.

(58) *Qu'un homme* here stands for *combien un homme.*

(59) *Un vilain* originally meant any person without nobiliary titles ; here, however, it plainly alludes to misers. Notice that the adjective *vilain* may mean either "nasty" or "ugly."

(60) *Est-ce que vous croyez* is more emphatic than *croyez-vous*, though both expressions mean one and the same thing.

HARPAGON. Et moi, je pourrais bien parler à ta barrette.[61]

LA FLÈCHE. M'empêcherez-vous de maudire les avaricieux ?

HARPAGON. Non ; mais je t'empêcherai de jaser, et d'être insolent. Tais-toi.

LA FLÈCHE. Je ne nomme personne.

HARPAGON. Je te rosserai,[62] si tu parles.

LA FLÈCHE. Qui se sent morveux, qu'il se mouche.[63]

HARPAGON. Te tairas-tu ?

LA FLÈCHE. Oui, malgré moi.

HARPAGON. Ha, ha.

LA FLÈCHE (*montrant à Harpagon une des poches de son justaucorps*). Tenez, voilà encore une poche. Etes-vous satisfait ?

HARPAGON. Allons, rends-le-moi sans te fouiller.

LA FLÈCHE. Quoi ?

HARPAGON. Ce que tu m'as pris.

LA FLÈCHE. Je ne vous ai rien pris du tout.

HARPAGON. Assurément ?

LA FLÈCHE. Assurément.

HARPAGON. Adieu. Va-t'en à tous les diables !

LA FLÈCHE, (*à part*). Me voilà fort bien congédié.

HARPAGON. Je te le mets[64] sur ta conscience, au moins.

SCÈNE IV.

HARPAGON.

Voilà un pendard de valet qui m'incommode fort ; et je ne me plais point à voir ce chien de boiteux-là.[65] Certes, ce n'est pas une petite peine que de garder chez soi une grande somme d'argent ; et bienheureux qui a tout son fait bien placé, et ne conserve seulement que[66] ce qu'il faut pour sa dépense. On n'est pas peu embarrassé à inventer, dans toute une maison, une cache fidèle ; car, pour moi, les coffres-forts me sont suspects, et je ne veux jamais m'y[67] fier. Je les tiens justement une franche amorce à voleurs, et c'est toujours la première chose que l'on va attaquer.

SCÈNE V.

HARPAGON, ÉLISE ET CLÉANTE

(*parlant ensemble, et restant dans le fond du théâtre*).

HARPAGON (*se croyant seul*). Cependant je ne sais si j'aurais[68] bien fait d'avoir enterré dans mon jardin dix mille écus qu'on me rendit hier. Dix mille écus en or chez soi est une somme assez . . . (*A part, apercevant Élise et Cléante.*) O ciel! je me serai trahi moi-même. La chaleur m'aura emporté ; et je crois que j'ai parlé haut en raisonnant tout seul. (*A Cléante et à Élise.*) Qu'est-ce ?

HARPAGON. And *I* might possibly speak seriously to you.

LA FLÈCHE. Will you prevent my cursing misers ?

HARPAGON. No, but I shall prevent your chattering and being insolent. Hold your tongue.

LA FLÈCHE. I name no one.

HARPAGON. I shall thrash you if you speak.

LA FLÈCHE. Let him put the cap on whom it fits.

HARPAGON. Will you hold your tongue ?

LA FLÈCHE. Yes, in spite of myself.

HARPAGON. Ha, ha.

LA FLÈCHE (*showing Harpagon one of the pockets of his doublet*). Look, there is another pocket. Are you satisfied ?

HARPAGON. Come, give it me back without my searching you.

LA FLÈCHE. What ?

HARPAGON. What you robbed me of.

LA FLÈCHE. I have not robbed you of anything at all.

HARPAGON. Assuredly ?

LA FLÈCHE. Assuredly.

HARPAGON. Farewell. Go to the devil !

LA FLÈCHE (*aside*). I am very well dismissed.

HARPAGON. I leave it to your conscience, at least.

SCENE IV.

HARPAGON.

That is a rascal of a servant who troubles me very much, and I am not at all pleased to see that lame dog. It certainly is not a little trouble to keep a large sum of money in one's house ; and he is very lucky who has safely invested his money, and keeps only what is needed for his *current* expenses. One is not a little puzzled to find in the whole of a house a safe hiding place ; for, as for me, safes (strong boxes) are suspicious, and I never will trust them. I look upon them as a bait for thieves, and it is always the first thing that is attacked.

SCENE V.

HARPAGON, ÉLISE ET CLÉANTE

(*talking together, and remaining at the back of the stage*).

HARPAGON (*thinking himself alone*). Yet I do not know whether I did right when I buried in my garden ten thousand crowns that were returned to me yesterday. Ten thousand crowns in gold at one's home is a sum sufficiently . . . (*Aside, perceiving Élise and Cléante.*) Oh heavens ! I most likely betrayed myself. My warmth has carried me too far ; and I think that I have spoken aloud while communing with myself. (*To Cléante and Élise.*) What do you want ?

(61) *Barrette* had the same meaning as *bonnet*, but *parler à sa barrette* was synonymous with *parler ferme et de près*, whereas *parler à son bonnet* means *se parler à soi-même*.

(62) *Rosser* originally meant to curry or cleanse (a horse).

(63) *Se moucher*, literally "to blow one's nose."

(64) *Je te le mets sur ta conscience.* Notice the use of both *te* and *ta* for the sake of emphasis ; under ordinary circumstances we would say, *je te le mets sur la conscience.*

(65) *Boiteux.* An allusion to an accidental lameness of the actor who was acting the part of La Flèche.

(66) *Seulement* is equivalent to *ne . . . que ;* this tautology was then intended to lay stress on that adverb.

(67) *Se fier* does not require the preposition *à* before its personal pronoun object when the latter is used in reference to things.

(68) *J'aurai.* We now more often use the present indicative *j'ai.*

CLÉANTE. Rien, mon père.
HARPAGON. Y a-t-il longtemps que vous êtes[69] là ?
ÉLISE. Nous ne venons que d'arriver.[70]
HARPAGON. Vous avez entendu . . .
CLÉANTE. Quoi ? mon père.
HARPAGON. Là . . .
ÉLISE. Quoi ?
HARPAGON. Ce que je viens de dire.
CLÉANTE. Non.
HARPAGON. Si fait, si fait.[71]

ÉLISE. Pardonnez-moi.

CLÉANTE. Nothing, father.
HARPAGON. Have you been there long ?
ÉLISE. We have only just come.

HARPAGON. You have heard . . .
CLÉANTE. What ? father.
HARPAGON. There . . .
ÉLISE. What ?
HARPAGON. What I have just said.

CLÉANTE. No.
HARPAGON. I beg your pardon ; I beg your pardon.
ÉLISE. Pardon me.

(*To be continued.*)

([69]) *Vous êtes.* The present indicative is required in French, because the person *is* still there, a fact but imperfectly denoted by the perfect tense used in English in that and similar instances.

([70]) *Nous ne venons que d'arriver.* Compare that expression with *nous venons d'arriver*, we have just arrived (come).

([71]) *Si fait* is said to be a contraction of *si, vous l'avez fait*, yes, you have done so. Notice that *si* is used instead of *oui* in answer to a question or an assertion containing a negative; *pleut-il ? oui, Monsieur*, does it rain ? yes, sir ; *ne pleut-il pas ? Si, Monsieur.*

OUR 1893 CERTIFICATE CLASS.

BY DR. GEORGE BEACH, M.A.

Co-Author of "A Manual of our Mother Tongue," "A Girls' Arithmetic." Author of "Elements of English," "Entertaining Readers," etc.

MODEL ANSWERS TO SCHOOL MANAGEMENT.

CERTIFICATE EXAMINATION.

SECOND YEAR (MEN AND WOMEN).

1 (*a*). Give a specimen of a class register, framed for one week's entries, and twelve names.

Admission No.	Age. Y.	Age. M.	NAME.	WEEK ENDING JULY 15th. M.	Tu.	W.	Th.	F.
				M. A.	M. A.	M. A.	M. A.	M. A.
12	7	1	Armstrong, Zephaniah	\ \	\ \	O \	\ \	\ \
13	7	2	Brown, Albert	\ O	O \	\ \	\ \	\ ⊕
110	6	3	Chesters, Benjamin	\ \	\ \	\ \	\ \	\ \
14	7	4	Dransfield, Charles	\ \	\ \	O \	\ \	\ ⊕
15	7	5	Evans, David	\ \	\ \	O \	O \	\ ⊕
1	8	6	Fowler, Ernest	\ \	\ \	O \	\ \	\ \
16	7	7	Godwin, Fred.	\ \	\ \	\ \	\ \	\ \
17	7	8	Hastings, George	\ \	\ \	O \	\ \	\ \
18	7	9	Ireton, Helen	\ \	\ \	O \	\ \	\ \
2	8	10	Jenkins, Izabella	\ \	\ \	\ \	O \	\ ⊕
19	7	11	Keene, Jemima	\ \	\ \	\ \	\ O	\ ⊕
3	6	12	Lester, Katherine	\ \	O \	O \	\ \	\ \
TOTAL			Boys	8 7	7 8	3 8	7 8	8 5
			Girls	4 4	3 4	5 4	3 3	4 5
Withdrawals, &c.			Managers' Signature, &c.				−7 −3 With.	+3 +5

N.B.—The punctual scholars are denoted by red ink strokes, (not here coloured) the late ones, who came in before closing of registers, by black strokes.

1 (*b*). Quote such brief entries as should be made in the log-book relating to these facts.

1 (*b*). *Log-book*, 13th July. Weather, very stormy this morning, seriously lowered the attendance; no less than 7 being absent. Attendance being so poor this morning, and several parents having notified their wish that their children should be absent to-morrow morning to view "Wombell's Wild Beast Show" (which is entering the town at 11 p.m.), I promised, having consulted the correspondent, to dismiss at that time. This was done to induce the scholars to attend. Although the nominal attendance will somewhat suffer, the children will thus not lose their instruction.

14th July. Pursuant to promise, school was dismissed at 11 p.m. and the attendances cancelled.

15th July. Three boys and two girls absent, attending drawing and cookery lessons respectively at the Technical School for two hours.

1 (*c*). Make out the week's summary.

1 (*c*). SUMMARY REGISTER, WEEK ENDING JULY 15th.

Class.	Attendances. Boys.	Attendances. Girls.	Total Attendances.	Times Open.	Average. Boys.	Average. Girls.	Total Average.	No. on Books.	No. Present during Week.
II.	65	32	97	10	6·5	3·2	9·7	12	12

2. What do you understand by the assertion that Arithmetic is a Science as well as an Art ? Illustrate your answer by showing how you would teach proportion (*a*) in a scientific, and (*b*) in a practical way.

(1) The theory of Arithmetic is Science, the skilful practice of it is Art.

(2) *Scientific Teaching of Proportion* :—

(*a*) Reduction of fractions to their lowest terms should be known so that it is understood that $\frac{3}{4}=\frac{6}{8}$, &c.

(*b*) Define *ratio* and show that it may be expressed by a Vulgar Fraction, and also by the signs "As 3 : 4" or "As 6 : 8." The two terms of a ratio must be of the same kind.

(*c*) Define *proportion* as the equality of ratios. Thus "As 3 : 4 :: 6 : 8."

(*d*) Prove from (*a*) that "*The product of the extreme terms is equal to the product of the mean terms.*" In the example $3 \times 8 = 4 \times 6 = 24$.

(*e*) Show that any one of the four terms may be found if the other three be given ; thus : As 3 : 4 :: 6 : x.

Here the product of the means is $4 \times 6 = 24$. Therefore the product of 3 and x must be 24 ; $\therefore x = 8$.

(*f*) Point out the operations, viz., that "*The second and third terms were multiplied together, and their product divided by the first.*" This gives the fourth term.

(3) *Practical Teaching*:—

Example : If A gives B 3 nuts out of 4, how many will he give B out of 8 ?

(*a*) Something is told, "A gives B 3 nuts out of 4." Something is asked, "How many will A give B out of 8."

(*b*) There are three terms, hence the name "*Rule of three.*" Two of these terms are in the *given* part, one of these in the *requesting* part.

(*c*) Find the third term first, as it must be of the *same kind* as the answer. It will always be in the given (the two-term) part of the problem. The question requires *nuts given* as answer, then *nuts given*, viz., 3, will be the third term. As : :: : *x*.

(*d*) A gives 3 out of 4, will he give more or less than 3 out of 8? Evidently more.

Then of the terms 4 and 8, the *more*, 8 must be the second term, and the *less* 4, be the first term. As $4 : 8 :: 3 : x$.

(*e*) Apply the rule and obtain $\frac{3 \times 8}{4} = 6$. Answer.

Now show that $\frac{4}{8} = \frac{3}{6}$.

(*f*) Give kindred problems such as:—

(*x*) If A gives B 6 nuts out of 8, how many will he give out of 4?

(*β*) If A gives B 6 nuts out of 8, how many will he have when he gives B 6?

(*γ*) If A gives B 3 nuts out of 4, how many will he have when he gives B 6?

3. If you were at the head of a school with a staff of one certificated assistant, two assistant teachers, and three pupil-teachers, how would you divide the duty between them, and what share of the teaching would you yourself undertake? What should be the average number of scholars in such a school?

The maximum average allowed would be:—

Head teacher - - - - - -	60
Certificated assistant - - - - -	70
2 assistants, 2 × 50 - - - - -	100
3 pupil-teachers, 3 × 30 - - - -	90
	320

In the case given, there are six teachers *with* the Head, and probably the 320 scholars would be distributed as follows:—

Standard I.	65	Scholars taught by assistant.	
,, II.	60	,, ,,	,,
,, III.	55	,, ,,	elder P.T.
,, IV.	48	,, ,,	junior P.T.
,, V.	40	,, ,,	head master.
,, VI.	35	,, ,,	certificated assistant
,, VII.	17	,, ,,	,, ,,

The certificated assistant would take Standards V., VI., and VII. *combined* for such subjects as Singing, Recitation, Drill, Writing in Copy Books, Transcription, Geography, and at times Reading and Dictation, leaving the head teacher free to discharge his peculiar duties.

4. Draw up an examination paper, such as would be suitable for a scholar leaving school at 13, and would properly test his or her knowledge in the three subjects of Arithmetic, English, and Geography *or* History.

In the optional subjects we will take Geography.

(*a*.) *Arithmetic.*—(1) Of an electric cable $\frac{11}{18}$ rests on the bottom of the sea, $\frac{1}{18}$ hangs in the water, and $234\frac{2}{3}$ yards are employed on land. What is the length of the cable?

Ans.—$2691\frac{1}{3}\frac{3}{3}$ yards.

(2) What is the cost of papering a room 21 feet long, $16\frac{1}{2}$ feet wide, $10\frac{1}{4}$ feet high at $6\frac{1}{2}$d per sq. yard.

Ans.—£2 6s. $3\frac{5}{24}$d.

(3) A invests £552 in the $3\frac{1}{2}$ per cents. when they are at 92, B invests £679 in the 3 per cents. when they are at 97. Find the difference in their incomes.

Ans.—£1 10s. 0d.

(4) If 9 men *or* 16 women could do a piece of work in 144 days, in what time would 7 men and 9 women do it working together? Give answer in decimals.

Ans.—107·4404145...days.

(*b*) *English.*—(1) Analyse the following passage and parse the italicised words:—

When I left the *lovely* place *where* I *was born*, I said, "*Oh! that* I *might* live *here for ever*."

(2) Derive the parts of the following words:—

Obstinacy, præternatural, unwisdom, misanthropical, epigram, inward.

(3) What Prepositions follow the appended words:—

Favourable, depend, indifferent, different, angry, satisfied, departed.

(4) Paraphrase:—

I have not tried to hide myself. I am he whom you seek, and to you, I at once give myself up. Deal with me as you like.

Geography.—(1) Where are you? What is your race? What natural privileges do you enjoy? What responsibilities have you to discharge as a member of your nation?

(2) What parts of the world would be best for an emigrant to go to who is an agricultural labourer, *or* an artisan, *or* a capitalist?

(3) What are the chief causes that determine climate?

(4) Show how physical geography has influenced political geography?

5. Write full notes of a lesson on one of the following topics, showing (*a*) for what class of scholars it is intended, (*b*) what visible or other illustration would be required, and (*c*) what is the educational object aimed at:—

(i.) The Savings' Bank;
(ii.) Some simple rules for preserving health;
(iii.) The use of metaphors;
(iv.) Plants used as food (*for an infant class*).

We will take some "simple rules for preserving health" in a lesson to be given to Standard VI. Specimens of clothing fabrics, Diagrams of circulation of blood and of the trunk of the body, and Specimens preserved in alcohol would be required as illustrations.

The educational objects (as distinct from mere knowledge) aimed at, would be the enlightenment of the intellect, the furtherance of the moral faculty, the due adjustment of the social instinct, and the formation of right habits.

NOTES OF LESSON.

(*a*) *What is health?* It is the state of wholeness or soundness of the whole being, a freedom from disease, weakness, and pain.

(*b*) *Perfect health* comprises (*a*) health of body, (*b*) health of mind.

There is a great inter-relationship and inter-action between body and mind. When the mind is ill at ease the body suffers, when the body is diseased the spirits suffer, and the intellect is often darkened.

(*c*) *Preservation of health* demands regular habits and conformity to certain physiological principles. These again presuppose the observance of rules.

(*a*) *Rules for preservation of bodily health.*

(1) Let the *diet* be plain, nourishing, sufficient in quantity, occasionally varied, and regularly partaken of.

(2) Enough time must be devoted to rest, sleep, and exercise at stated times, and excesses of any kind must not be committed.

(3) The clothing must be warm, loose, not too heavy, and adapted to the climate and occupation.

(4) The habitation should be properly ventilated, supplied with pure water, free from damp, well lighted, and fairly comfortable.

(*c*) *Rules for preservation of mental health.*

(1) The mind must be occupied, but not strained or overworked.

(2) A cheerful disposition must be cultivated.

(3) Sufficient diversions must be allowed.

(4) The organs of sense, especially the eyes, should be well-cared for.

(5) Morality must be scrupulously guarded.

6. Write a short essay on the relative values of manual and intellectual training, and show how both ought to be kept in view in the management of a school.

Man is a complex creature, possessing both body and mind, and lives surrounded by a material environment subject to well-designed laws.

To support his body and to advance his species, he must manipulate matter with his hands, and also intellectually appreciate the force of natural laws and principles.

The relative value of manual and intellectual training cannot be accurately determined upon general principles. It must be considered with respect to the individual and his concomitant circumstances.

To a man born to wealth or destined to a sedentary career, intellectual training is of more utilitarian value than manual training. Moreover, each one's idiosyncracy must be studied.

Yet neither kind of training should be altogether neglected. This is a world of vicissitudes and change. The poor man of to-day may be to-morrow's millionaire, and the wealthy man may be quickly reduced to poverty.

Under these changed circumstances, were the intellect of the former and the manual capabilities of the latter untrained, disaster or unhappiness would result.

Everyone, therefore, as in the German Imperial family, should learn a trade, and all should also have a fair amount of mental education.

If the rich man never requires his manual faculties for bread-earning, they will assist him in making home comfortable, and will provide him with pleasant recreation.

In school the acquisition of knowledge should always be productive of intellectual advancement, and mere memory work should be as far as possible discouraged; but, beginning at the earliest years, Kinder-garten occupations (such as clay modelling), and afterwards proceeding through joinery, drawing, and wood carving, should train the hand unto dexterous skill.

7. Describe the best method you know of keeping the air of a school-room fresh and pure, and of maintaining a uniform temperature throughout the day.

(*a*) Freshness of air in a school-room can only be maintained by a constant removal of vitiated air, and a steady supply of pure. The best methods are those which promote circulation without creating a draught. Tobin's tubes or equivalent contrivances are probably as yet the best devised system. (See p. 168 of "Hughes's Domestic Economy," and also p. 86 of Dr. Carpenter's "School Hygiene.")

(*b*) A uniform temperature cannot be maintained unless there be a uniform means of supplying heat. Obviously, fires, which are flaming one minute and choked with fuel the next, will not pour in a steadfast supply. Similarly, but in a less degree, stoves are defective unless on the slow combustion principle, and manufactured of fire-clay.

Hot-water pipes are the best, but are costly. The apparatus is liable to go wrong at most inconvenient moments, but there is a modification by Messrs. Wenham and Waters, of Croydon, which removes many of the objections.

If the water be kept at a sufficiently high temperature for some time before the school meets, the windows being closed, this will be the proper measure of uniform heat to be preserved during school hours with ordinary windows open. For the extra escape of heat will be counterbalanced by the extra supply from the human frame.

8. (*a*) What is to be understood by "Habit?" (*b*) What laws of mental science control the formations of habits? (*c*) Say what it is in the power of school discipline to do in the encouragement of right habits.

(*a*) *Habit* is that settled disposition, called forth by repeated exercise, which leads man to judge, to reason, to will, and to perform more and more mechanically in the same, or a similar manner, as heretofore.

(*b*) Habits must be—
(1) (Allowing for circumstances) voluntarily acquired.
(2) The result of frequent repetition.
(3) Formed by acts having the same intent.
(4) Called into play by "association of ideas."

(*c*) School discipline may encourage right habits by—
(1) Influencing the will in their favour by means of pleasure and pain, and example.
(2) Affording opportunities for acts which create habits.
(3) Removing obstacles in the way of their formation.
(4) Encouraging, not merely one isolated right habit, but a *system* of right habits.

Habitual truth telling, sympathy, punctuality, cleanliness, politeness, may be established by judicious school discipline, if not unsettled by unfavourable indiscipline elsewhere.

9. (*a*) What is meant by a perfect definition? (*b*) What processes of thought are involved in framing one? (*c*) Give examples of good and of imperfect definitions, and assign your reasons? (*d*) How far is it desirable, if at all, to require definitions to be learned by heart?

(*a*) A perfect definition is one which unfolds the full connotation of the term and nothing else.

(*b*) The processes of thought involved in framing a perfect definition are:—
(1) Conception, or the power of forming a general notion.
(2) Comparison, or the power of detecting resemblances and differences.
(3) Abstraction, or the power of considering essential points by themselves.
(4) Generalisation, or the power of forming a class of similar things.

(*c*) *Example of a good definition*:—
(1) "Man is a rational animal."

This is a good definition, because the genus *animal* is mentioned, and the essential difference, *rational*, is also given.

The word *animal* excludes all other beings, and the word *rational* excludes all other animals.

(2.) "*Man is an animal*," "*Man is a natural being*," are obviously imperfect as definitions by reason of their breadth.

"*Man is a masculine rational animal*" is imperfect as being too exclusive.

(*d*). It is frequently desirable that definitions should be committed to memory as—
(1). They summarise a certain amount of knowledge.
(2). They give permanent clearness of the essential ideas, and afford a test for classifying things.
(3). They are models which assist the mind to form for itself other definitions.

10. Explain, and illustrate by examples, the use of the terms, ambiguity, convertible, categorical, hypothesis, inference.

(*a*). *Ambiguity* is duplexity of meaning and vitiates a syllogism when it affects the middle term, *e.g.*

Abstraction is a mental condition.
Picking pockets is *abstraction*
∴ Picking pockets is a mental condition.

(*b*). *Convertible* terms are such as are exactly equivalent, so that one may be predicated of the other indiscriminately, *e.g.*

"A human being is a rational animal" may be converted into "A rational animal is a human being."

Every perfect definition may be converted.

(*c*) *A categorical* proposition is one that simply asserts that an individual belongs to a species, a species to a genus, or a genus to the summum genus, &c.

Thus "Man is an animal" is a categorical proposition.

(*d*). *A Hypothesis* is a supposition which is made without evidence (or sufficient evidence) in order that we compare its conclusions with actual facts, and thus at last arrive at some general law after the elimination of false hypotheses.

The theory of gravitation was at first merely a hypothesis until substantiated by astronomical observations and calculations.

The fluid theory of electricity was a hypothesis that has had to be abandoned in consequence of further scientific knowledge.

(*c*) *Inference* is a proceeding from one judgment to another contained in the former. Thus we infer from "*Socrates was virtuous*" that "*Socrates was not a liar.*" Some logicians extend the term inference so as to comprise syllogistic and inductive conclusions.

11 (*a*). Distinguish between the meaning of the terms *Abstract* and *Concrete*. (*b*.) Show the application of those terms (1) to parts of speech and (2) to arithmetic. (*c*.) Say what is the use of the distinction.

(*a*) (1) The term *Abstract* is used to characterise anything which only exists independently in the mind, and is mentally abstracted from the thing to which it appertains. Names of qualities, attributes, circumstances, are abstract. They are non-connative.

(2) The term *Concrete* designates having a real existence in themselves.

(*b*) (1) An *Abstract* noun is the name of some quality, &c., such as *roughness*, which can only exist by inhering to some concrete thing.

A *Concrete* noun is the name of some thing which has in itself a real or supposed existence; *e.g.*, London, town, man.

(2) An *Abstract* number is one that is employed apart from measuring or numbering things, as 607. Similarly, we may have *Abstract* propositions and calculations.

A *Concrete* number is one applied to measure or number things (whether abstract or concrete), as 6 *qualities*, 10 *men*.

(*c*) In grammar the distinction is of little or no use, but in arithmetic it is serviceable. Thus we may state that (1) "two concrete numbers cannot (except by convention) be multiplied together"; (2) a concrete number may be multiplied by an abstract number; (3) two abstract numbers may be multiplied together.

Mr. Herbert Spencer.

12 (*a*). Criticize and illustrate one of these extracts :—

(i.) "The development of the mind is an advance from the indefinite to the definite."

(ii.) "For the training of mere memory, science is as good as—if not better than—language. It has an immense superiority in the kind of memory it trains."

The development of the mind undoubtedly proceeds from the indefinite to the definite, for taken as the author meant it, it is merely a truism. When the limitations (L. *fines*) of a thing are unknown, not only as regards its size, but its weight and other properties, nothing is known accurately except its mere existence. But as we learn the extension, the weight, the colour, the properties, we gradually narrow the classes to which it may belong, until we accurately know the limit of its range, and we can define it or ascertain that our knowledge is definite.

A hollow green ball is given to a mere infant. Its ideas respecting it are at first almost unlimited, but it gradually learns its size, its weight, its hollowness, its colour, its elasticity, and perhaps its taste.

13 (*a*). Comment on this author's observations on poetry and the fine arts, and on their relation to human life and well-being.

Without poetry and the fine arts (says Spencer) life would lose half its charms, and as civilization advances, "the beautiful" will fill an increasingly larger space. Yet, at present, elegance must often give way to subsistence and substance. Just as aesthetics occupy the leisure part of life, so should they occupy the leisure part of education. They are the flower of the plant civilization. The highest art must be based upon science. Then will not be seen such errors as in the Discobolus and Chinese pictures have been perpetrated. In poetry the same truth holds. It must pay attention to the science of nervous action which excited speech obeys.

The neglect of this science has given us pyramids of bombast and doggerel, and has rendered didactic poetry unpopular.

Mr. Herbert Spencer is seldom wrong, and not often altogether right. It seems daring to say that the finest art, whilst not contradicting nature and science, should surpass them both—should idealise both. In a picture the main figures are more prominent, and the accessories more subordinated than in nature; in oratory and poetry that aspect of the question dwelt upon is emphasised, and contrary views neglected or only disparingly referred to.

Mr. Spencer's view appears defective in not distinguishing between the different human faculties to which science and art appeal. It is a fact that pictures and statues exist glaringly defective in the eye of science, but powerful in moving the depths of human feeling. There are also strictly accurate scientific productions, which lacking the *soul* that art only can supply, are as lifeless, as powerless, and as inert as a syllogism.

14 (*a*). What is meant by insisting on the importance of self-development? And what practical conclusions respecting methods of education does the author deduce from his argument on this subject?

(1) *Self-development* is the only sound method of development. Any rational system of education assists and guides, but does not supersede *self-development*. Spencer remarks, "It cannot be too strongly insisted on that in education the process of self-development should be encouraged to the uttermost." Just as a plant must grow in its own way, must take its predestined form, and bring forth its foreordained fruit, whilst all that the gardener can do is to supply the most favourable and stimulating environments; so the mind must develop according to its own idiosyncracy, must cultivate its peculiar abilities, and ripen its own indigenous products, whilst all that the teacher achieves is to assist self-effort by affording suitable pabulum and exercises.

(2) This stamp of individuality affords a good test as to whether a child is being properly educated. If so, then the process is pleasurable; if not, the reverse the case. What consists and consorts with one's being is agreeable; and if the educational system adopted runs parallel with the automatic methods that the child's nature mechanically suggests, then all is well.

15 (*a*). Discuss, from the author's point of view, and from any experience of your own, the nature and value of good Object Lessons.

(*a*) In accordance with the preceding answer, the nature and value of Object Lessons is such as to continue and cultivate the knowledge and faculties obtained and sharpened by self-development. As soon as a child is capable of tuition—and who shall say at how early a point this stage commences?—the mother at home should begin infantile Object Lessons upon the objects around. Nothing suitable that passes under the child's observations but should be subservient to that child's development.

When the child passes from the home to the school—its first step into the world—then, undoubtedly, it should commence acquaintance *first of all* with the new objects that call forth its attention by intruding themselves upon it. So shall it be trained to live in a practical world.

The value of Object Lessons is two-fold. They not only look to the present day and suit the child for child-life, but they impart the knowledge of, and train the intellect to deal with, matter that will be met with in more adult life. Moreover, it must not be forgotten, that generalisation and abstraction is absolutely foreign to the young child, and that educational nutriment must be presented to it in the only form in which it will be digested, viz., the concrete. Now nothing educational is more concrete than an Object Lesson.

John Locke.

12 (*b*). In what sense does this author mean that learning should hold only the second place in education; and what are the "greater qualities" to which he would give preference?

(*b*) Locke allows learning to be a necessary but not the chief business, inasmuch as a virtuous or wise man is infinitely to be valued before a great scholar. Indeed learning makes some natures more foolish, and worse; but as it must be had, it must be relegated to the *second place* and made subservient only to the *greater qualities* of innocence, good inclinations, and good habits.

13 (*b*). Amplify and illustrate one of these extracts :—

(i) "Cunning is only the want of understanding."

(ii) "Nothing but obstinacy should meet with imperiousness or rough usage."

Cunning is only the want of understanding, the ape of real wisdom and the sign of that incapacity which, being unable to succeed by direct methods, adopts tortuous ones. Wisdom not only avails to secure its ends, but increases reputation; whereas a cunning trick helps only once, but hinders ever after; cunning is founded upon falsehood, but wisdom is established upon truth.

Therefore to tread the lower, the less reputable, and the less serviceable path, argues a want of understanding.

The shopkeeper who tricks his customer does not understand that he will be deserted for a more reliable tradesman, the politician who palters in a double sense lacks the perspicuity to see that sooner or later he will be abandoned, and the schoolboy who cheats his master and his comrades does not discern the retributive suspicion and contempt with which he will be regarded.

A national breach of faith, such as the repudiation of the Public Debt, may be cunning enough to secure some immediate advantage, but it lacks the understanding that such advantage is dearly purchased by the loss of Public Credit.

14 (*b*). Discuss the view taken in the "Thoughts concerning Education" on the subject of the teaching of Grammar.

(*b*) Locke simply looks upon the external advantages to be obtained from learning Grammar such as it being the necessary equipment of an author, and denies that it is needed for the common affairs of life and ordinary commerce. The Rev. Canon Daniel says (p. 300 of his valuable edition of Locke's "Thoughts"): "This is a very narrow view of the object of the study of language, it is the courier's and the commercial traveller's view. Language is a key to the history and inner life of a people, not merely by being a key to its literature but in itself. In its study we are compelled to examine more closely the *ideas* which our words cover. The structure of every sentence is also a lesson in logic."

15 (*b*). What place do Geography and History hold in Locke's scheme of a liberal education; and how does he support their claims?

(*b*). (α) At the same time that a child is learning French and Latin he may also (Locke thinks) be entered in Arithmetic, *Geography*, Chronology, *History*, and Geometry too. Of these subjects Geography should be the first, its elementary portions being only an exercise of the eyes and memory, and such as are learned and retained with pleasure.

Our author wanders, however, from the right path in deeming that the above subjects should be taught in a foreign language, as *the true teacher presents difficulties singly*.

(β) History should be taught subsequently to Chronology, and the order of time and place should govern. This subject is the great mistress of prudence and of civil knowledge, and ought to be the proper study of a gentleman or man of business in the world.

Locke appears to attach too much importance to mere dates.

CERTIFICATE ROUTINE FOR **APRIL**, 1893 (MEN AND WOMEN, FIRST YEAR).

DAYS	FIRST WEEK.			SECOND WEEK.			THIRD WEEK.			FOURTH WEEK.		
	I.	II.	III.	I.	II.	III.	I.	II.	III.	I.	II.	III.
MONDAY	Training of the Ear	Read Second half of "Geraint and Enid," *or* 25 pp. of Johnson's "Life of Milton."	Euclid, Book III., Props. 24 to 31, *or* Repairing Underclothing	General Principles of Teaching	Study the Notes of "Geraint and Enid," *or* of first 25 pp. of "Life of Milton"	Euclid, Book III., Props. 32 to 37, *or* Paper Pattern of an Infant's Shirt	Cultivation of the Intelligence	Analyse lines 101 to 111 of "Geraint and Enid," *or* Lines 437 to 446 of Book II., "Paradise Lost." Parse difficult words	Euclid, Book III., Props. 1 to 7, *or* Any Needlework	Training of the Voice	Analyse and Parse from Lecture IV., *or* Lines 506 to 514, Book I., "Paradise Lost"	Euclid, Book II., *or* Organs of Respiration
TUESDAY	Chief Dates from 1461 to 1503	Simultaneous Quadratics, *or* Functions of Food	Geography of Turkey in Asia.	Chief Dates from 1503 to 1553	Algebraic Factors, *or* Materials and Cost of Clothing	Causes which affect Climate	Wars with France from 1066 to 1461	L.C.M. and G.C.M. of Algebra — Construction of the Home	Physical Geography of China	Chief Dates from 1553 to 1603	Arithmetical and Geometrical Progressions, *or* Composition and Uses of Fresh Air	Distribution of Plants
WEDNESDAY	Compound Interest	History from 1461 to 1503	Any Arithmetic	Stocks	Any Revision	Mixtures, *or* Theory of Interest	Stocks, *or* Simple Proportion	Any Revision, *or* pp. 60 to 90 "Burke's Reflections"	Clock Sums	Equation of Payments, *or* Stocks	Any Revision, *or* "Burke's Reflections"	Political Geography of China
THURSDAY	History from 1714 to 1727, *or* Wars with Scotland from 1066 to 1461	Simultaneous Quadratics, *or* Organs of Mastication and Digestion	Physical Map of China	History from 1503 to 1553	Simultaneous Simple Equations, *or* Care, Cleansing, and Use of Clothing	Effects of Climate on Industry and Productions	Ecclesiastical Affairs from 1066 to 1553	Algebraic Surds, *or* Furnishing of the Home	Map of Hindostan	History from 1553 to 1603	Harmonical Progression, *or* Ventilation	Sequence of Intellectual Development
FRIDAY	Notes of a Writing Lesson to Standard II.	Deductions on Euclid, Book I., *or* Diagram of an Infant's Shirt	Analyse lines 1 to 7 of "Geraint and Enid," *or* Lines 356 to 363 of "Paradise Lost," Book I. Parse difficult words	Exchange, *or* Theory of Proportion	Study Lecture IV., *or* pp. 25 to 50 of "Life of Milton"	How to Teach Spelling	Present Worth, *or* Simple Proportion	Deductions on Euclid, Book II., *or* Study of Prosody	Write Notes of a Lesson as for Standard VII. upon the lines set for Monday's Analysis.	Averages	Deductions on Euclid, Book III., *or* Answering Needlework Questions	Read Lecture IV., *or* pp. 50 to 74 of "Life of Milton"
SATURDAY.	Music, Relations as Denoted by Tonic, Dominant, etc.	Science	Drawing	English Composition, upon Tennyson's Love of Nature, *or* Milton's Domestic Life	Music, Transposition from one Key to another	Science	Drawing	Repetition, Literature, and Penmanship	Musical Accidentals	Science	Drawing	Paraphrasing (see Article)	Musical Terms in Common Use	Science	Drawing	Repetition, Literature, and Penmanship

CERTIFICATE ROUTINE FOR **APRIL, 1893** (MEN AND WOMEN, SECOND YEAR).

DAYS	FIRST WEEK.			SECOND WEEK.			THIRD WEEK.			FOURTH WEEK.		
	I.	II.	III.	I.	II.	III.	I.	II.	III.	I.	II.	III.
MONDAY	Summary Register and How to keep it	Read "Macbeth," Act II., *or* "Hamlet," Act II.	Revise Euclid, Book I., *or* Print Patch	Warming, Colouring, and Lighting of School Premises	Read "Geraint and Enid," *or* "Advancement of Learning"	Revise Euclid, Book II., *or* Diagram of a Boy's Shirt	Notes of a Dictation Lesson to Standard VI.	Paraphrase lines 124 to 132 of "Macbeth," Act II., Scene 4, *or* Lines 555 to 571 of "Hamlet," Act II., Scene 2	Revise first 20 Props. of Euclid, Book III., *or* Linen Patch	Organisation of Mixed and Half-time Schools	Analyse lines 1 to 10 of "Macbeth," Act III., Scene 1, *or* Lines 181 to 189 of "Hamlet," Act III., Scene 1. Parse difficult words	Euclid, Book III., Props. 21 to 37, *or* Any Revision
TUESDAY	Chief Dates from 1399 to 1478, *or* Revision	Insurance	As in First Year, *or* Physical Geography of New Zealand	History as in First Year, *or* From 1558 to 1581	Stocks	As in First Year — Political Geography of New Zealand	Chief Dates from 1478 to 1527, *or* Colonial and Geographical Enterprise in the Tudor Period	Discount	As in First Year — Political Geography of Australia	History as in First Year, *or* Social History from 1558 to 1603	Ratio and Proportion	As in First Year — General Geography of Australia
WEDNESDAY	Analyse lines 33 to 41 of "Macbeth," Act II., Scene 1, *or* Lines 471 to 481 of "Hamlet," Act II., Scene 2. Parse difficult words.	Problems leading to Quadratics, *or* Choice of Food	Jevon's Logic, pages 7-22	Read Lecture V., *or* Notes on "Hamlet"	The Health of Scholars and Teachers	Permutations — Food for the Sick	Mensuration, *or* Any Revision	Combinations, *or* Investments	Pp. 22-41 of Spencer, *or* Sections 157 to 168 of Locke	The Admission Register, and How to keep it	Permutations and Combinations, *or* Investments	Any Geography
THURSDAY	History from 1509 to 1553, *or* History from 1553 to 1558	Stocks	As in First Year — Physical Map of Australia	History from 1553 to 1603, *or* From 1581 to 1603	Race Problems	As in First Year — Physical Geography of Australia	History from 1603 to 1649, *or* Social History from 1485 to 1558	Stocks	As in First Year — Map of Scotland	History from 1649 to 1688, *or* Scotch Affairs from 1485 to 1509	Compound Interest	As in First Year — Commercial Geography
FRIDAY	Problems in Simultaneous Quadratics, *or* Beverages for the Sick	Euclid, Book IV., first 10 Props., *or* Diagram of a Boy's Shirt	Formation of Habits and Character	Permutations — Cooking Ordinary Flesh Meat	Euclid, Book IV., *or* Cutting out in Paper of a Boy's Shirt	Mensuration, *or* Any Revision	Permutations and Combinations, *or* Duties of a Housemaid	Definitions of Euclid, Book V., *or* Diagram of a Child's Muslin Pinafore	Read Lecture V., *or* "Advancement of Learning"	Surds, *or* Economy of Food	Euclid, Book IV. and Definitions of V., *or* Diagram of a Child's Muslin Pinafore	Paraphrase lines 58 to 63 of "Macbeth," Act III., Scene 1, *or* Lines 74 to 86 of "Hamlet," Act III., Scene 2
SATURDAY.	Music / Science / Drawing / English Composition upon the character of "Duncan," *or* "The King," in "Hamlet"			Music / Science / Drawing / Repetition, Literature, and Penmanship			Music / Science / Drawing / English Composition upon the character of "Banquo," *or* "The Queen," in "Hamlet"			Music / Science / Drawing / Repetition, Literature, and Penmanship		

SELECTED GOVERNMENT QUESTIONS.

FIRST YEAR.

First Week.

1. Write in large hand the words "*Beneficent Strategy.*"
Write in small hand the lines—

"*The nations not so blest as thee*
Must in their turn to tyrants fall."

2. Write from Dictation :—

"It was not well with Italy; she might fill the world with exquisite specimens of her skill in the arts, with pictures and statues of rarest loveliness, but all higher national life was wanting to her, during those centuries in which she degraded 'virtuoso,' or the virtuous man, to signify one skilled in the appreciation of painting, music, and sculpture; for these, the ornamental fringe of a nation's life, can never, without loss of all manliness of character, be its main texture and woof."

3. What are the tests of good reading? Discuss the importance and usefulness of (*a*) pattern reading, (*b*) of silent reading, and (*c*) of simultaneous reading.

4. Distinguish between *apprehension* and *comprehension*, and between *perception* and *conception*, and show the bearings of this distinction on the work of a teacher.

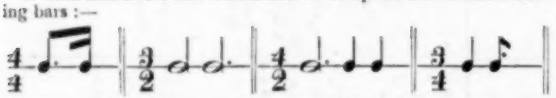
5. Write minor sixths above F, A, D, G ♯, and imperfect fifths above E, G, F, A.

(*Tonic Sol-fa*) Re-write the following in four-pulse measure, doubling the value of each note and rest :—

(*a*) | m .r,d : t, .r || (*b*) | d,m : s || (*c*) | l. : s ||

(*d*) | d : - .r || (*e*) | m : — || (*f*) | .d : d ||

6. Add first a rest and then a note to complete each of the following bars :—



(*Tonic Sol-fa*) Write a moderately difficult time exercise in eight three-pulse measures, suitable for study by children in the highest standards. No two measures should be exactly alike. Use the letter '*d*' throughout.

7. (*Men only.*) Give the substance of Trench's remarks on synonyms and on duplicate words, and illustrate your answer by examples.

(*Women only.*) Analyse the following, and parse the words italicised :—

"Of man's first disobedience, and the *fruit*
Of that forbidden tree, *whose* mortal taste
Brought death into the world, and *all* our *woe*,
With loss of Eden, *till* one greater Man
Restore us, and regain the blessful *seat*,
Sing, heavenly *muse*, *that* on the secret top
Of Oreb, or of Sinai didst *inspire*
That shepherd *who* first taught the *chosen* seed."

8. Explain the metre of the poems which you are studying. Quote four lines and show their structure by careful scanning.

9. Draw a map of Palestine.

10. "Within the tropics a height of about 18,000 feet above the sea level gives a range of climate equivalent to a distance of 4,500 miles north or south of the equator." Explain and illustrate this passage with special reference to the distribution of plants.

11. Enumerate the chief battles fought in the "Wars of the Roses." How did this struggle tend to strengthen monarchy?

12. (*Men only.*) What naval battles did we fight in the 18th century, between what commanders, in what wars, and with what issues? Give dates.

(*Women only.*) Narrate the decline of the English power in France in the reign of Henry VI.

13. By disposing of goods for £364 a man loses $\frac{4\frac{1}{2}}{50}$ of what he gave for them. What should be the selling price to gain $\frac{1\frac{1}{2}}{25}$ of their cost price? Ans. £428.

14. (*Men only.*) Show that if a quantity measures both *A* and *B*, it will measure $mA + nB$.

(*Women only.*) From what plants may (1) starch and (2) sugar be obtained respectively? Give an account of the use of starch in washing clothes, and explain the difference between hot-water starch and cold-water starch. Describe the nutritive value of sugar.

15. (*Men only.*) (*a*) Prove that $a - (b - c) = a - b + c$.

(*b*) If $x^2 + y^2 + z^2 = 1$, prove that $(x + y + z)^2 = (1 + y - z)(1 + z - y) + (1 + z - x)(1 + x - z) + (1 + x - y)(1 + y - x)$.

(*Women only.*) Why are fresh vegetables a necessary part of a good diet, especially in summer? Draw up a list of vegetables, mentioning those that are most nutritious.

16. (*Men only.*) A circle, an equilateral triangle, and a regular hexagon, each have the same perimeter, viz. 150 feet. Compare their areas. Ans. $21\sqrt{3} : 22 : 33$.

17. (*Men only.*) Write out Euclid, II. 12.

What is the meaning of the statement "The sum of two squares is equal to a third square?"

What is a gnomon?

(*Women only.*) Food is frequently described as (*a*) warmth-giving, (*b*) flesh-forming, and (*c*) bone-making. Explain as to an upper class of girls the truth of this statement.

18. (*Men only.*) Write out Euclid, III. 7.

If one circle touch another internally at P, show that the straight lines joining the extremities of two parallel diameters of the circles, towards the same parts passes through P.

Third Week.

1. Write in large hand the words "*Devonian Ranges.*"
Write in small hand the words—

"*A time there was, ere England's griefs began,*
When every rood of ground maintained its man."

2. Write from Dictation :

"It is not merely the widening of men's intellectual horizon, which, bringing new thoughts within the range of their vision, compels the origination of corresponding words; but as often as regions of this outward world hitherto closed are laid open, the novel objects of interest which these contain will demand to find their names, and not merely to be catalogued in the nomenclature of science, but, so far as they present themselves to the popular eye, will require to be popularly named."

3. Give what you consider a suitable time-table for the studies and employments of a pupil teacher in the third year.

4. "A *pen* to register; a *key*
That winds through secret wards,
Are well assigned to memory
By allegoric bards,
As aptly also might be given
A *pencil* to her hand;
That softening objects, sometimes even
Outstrips the heart's demands."

How far do any of these metaphors accurately describe the nature and functions of memory? Give reasons for your answer.

5. State the names of the following intervals :—

A ; C♯ ; F ; B♭ ; D♯ ; E
F♯ ; E ; A♭ ; G ; A ; B♭

(*Tonic Sol-fa*) Re-arrange the following notes in ascending order of pitch, and state the pitch of the highest note, supposing the key to be E♭ :—

(*a*) s n' r t, f r' n l, l d s, ; (*b*) ta f r ta, fe l r' d s f,

6. Fill up two measures or bars in each of the following times :—

$\frac{4}{4}$; $\frac{3}{4}$; $\frac{4}{2}$

Introduce one rest, and at least two notes in each bar. Vary the contents of the two bars of each time.

(*Tonic Sol-fa*) Write in figures over the following the duration value in pulses, or fractions of a pulse, of each note and rest :—

| m : -.s | d : — | r.,f : n.d | s : | l,s,f : n. | f : — |

| -.n : r,n.f | n : — ||

7. Write a brief essay on the Advantages and Disadvantages of Free Education.

8. (*Men only.*) Analyse the following lines, and parse the words in italics :—

Then Bellicent bemoaned *herself* and said,
Hast thou *no* pity on my loneliness?
Lo! where thy *father Lot* beside the hearth
Lies like a *log*, and all but *smouldered out!*
For ever since, *when traitor* to the King
He *fought* against him in the *Barons'* war,
And Arthur gave *him back* his *territory*,
His age hath slowly *drooped*.

(*Women only.*)—

Him the Almighty Power
Hurled *headlong flaming* from the ethereal sky,
With hideous ruin and *combustion down*
To bottomless perdition ; *there to dwell*
In adamantine chains and penal *fire*,
Who durst defy the *Omnipotent* to arms.

9. How may it be determined by measurement that the earth is not spherical? Why is the solar day an unfit measurement of time? What is the mean solar day?

10. Describe the mountain and water systems of Western Asia.

11. What English sovereigns died violent deaths? Give dates.

12. (*Men only.*) What influence did the French Revolution exercise upon the statesmen and people of England?

(*Women only.*) Relate the progress of the Reformation during the reigns of Henry VIII. and Edward VI.

13. If one pound of tea be worth 50 oranges, and 70 oranges be worth 84 lemons, and 20 lemons cost 1*s.*, what is the price of the tea? Ans. 3*s.* per lb.

14. (*Men only.*) Assuming the rule for finding the G.C.M. of two expressions, show how to find it for three expressions.

(*Women only.*) How could you demonstrate to a class—(*a*) That linen conveys heat from the body more quickly than wool ; (*b*) That warmed linen gets cool more quickly than warmed wool ; (*c*) That linen absorbs moisture more quickly than wool ; (*d.*) That linen fibre is different in structure from woollen fibre?

15. (*Men only.*) Find G. C. M. of $343\,p^2q^2r\,(3x^4-11x^3+7x^2-4x+3)$ and $441\,pq^2r^3\,(4x^4-15x^3+11x^2-7x+3)$.
Ans. $49\,pq^2r\,(x-3)$.

(*Women only.*) How could you most profitably spend £7 in providing yourself with a complete outfit suitable for the mistress of a country or town school?

16. (*Men only.*) How many panes of glass each $4\frac{3}{4}$ by $3\frac{3}{8}$ inches will be required for a window with a semicircular head, whose extreme height is 35 feet, and width 14 feet? Ans. 4020.

17. (*Men only.*) Write out Euclid I. 27.

If a straight line terminated by two intersecting straight lines be bisected, no other straight line terminated by the intersecting lines can be bisected at that point.

(*Women only.*) Of what advantage to health have you been taught to consider drill?

18. (*Men only.*) Write out Euclid II. 14.

Describe a right-angled isoceles triangle equal to a given rectlineal figure.

SECOND YEAR.

First Week.

1. As in First Year.

2. As in First Year.

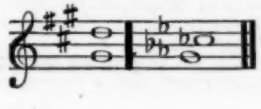
3. To what practical purposes should you put (1) a School Library, (2) a School Museum ; and what class of specimens should you include in both?

4. What purposes—disciplinal and practical—are served by teaching drawing in schools? Describe a course of drawing exercises suited either for :—

(*a*) An infant school, *or*
(*b*) A school of older children.

5. State the names of the following intervals :—

B♯, D♭, D♯,
D, E, C,



OR

State the names of the following intervals :—

de le la fe ta f
fe, r, t$_1$, la$_1$, m, se$_1$.

6. As in First Year.

7. (*Men only.*) As in First Year.

(*Women only.*) What are the broad features of Bacon's literary style? Mention any peculiarities of his vocabulary.

8. (*Men only.*) What position in the "Idylls of the King" does "Geraint and Enid" occupy? How is the commencement of the degeneration of the "Table Round" hinted at?

(*Women only.*) Explain "your Majesty standeth invested of that triplicity," etc.; "Saint Paul gives a *caveat*" ; "the fable of Ixion" ; "quinquennium Neronis" ; "the custom of the Levant."

9. (*Men only.*) As in First Year.

(*Women only.*) Describe with statistics the lake systems of the British Isles.

10. (*Men only.*) As in First Year.

(*Women only.*) Enumerate the political divisions of Australia, mentioning three towns in each.

11. (*Men only.*) As in First Year.

(*Women only.*) Write short lives of Sir Thomas More, Cranmer *or* Sir Walter Raleigh.

12. (*Men only.*) As in First Year.

(*Women only.*) Describe the personal character of each of the Tudor sovereigns.

13. (*Men only.*) If n is any positive integer, find the value of—

$$n^{n+3}-n(n-1)^{n+3}+\frac{n(n-1)}{1\times 2}(n-2)^{n+3}-\ldots\ldots$$

Ans. $\frac{n+3}{24}\left\{\frac{n}{24}+\frac{n(n-1)}{12}+\frac{n(n-1)(n-2)}{48}\right\}$.

(*Women only.*) Simplify $\frac{\sqrt{25\cdot4016}-\sqrt{1\cdot0609}}{\sqrt{25\cdot406}+\sqrt{1\cdot0609}}$. Ans. $\frac{401}{607}$.

14. (*Men only.*) As in First Year.

(*Women only.*) Cut out in paper the right half of a woman's night-dress.

15. (*Men only.*) As in First Year.

(*Women only.*) What are the chief processes through which food passes in the process of digestion? Why is bread unsuitable for very young infants?

16. (*Men only.*) Find the cost of a cylindrical leaden pipe of $1\frac{1}{2}$ inches bore, which is $\frac{1}{2}$ inch thick and 12 yards long, at $2\frac{1}{2}d.$ per lb., supposing a cubic foot of the metal to weigh 11·088 ozs.
Ans. £3 9*s.* $3\frac{1}{2}d.$

(*Women only.*) Explain the terms phosphate, cereal, albumen, leguminous, fibrin, and case in, and give examples of their use.

17. (*Men only.*) Divide $6x^{\frac{1}{3}}-96x^{-\frac{1}{3}}$ by $x^{\frac{1}{3}}-2x^{-\frac{1}{3}}$.
Ans. $6(x+2x^{\frac{1}{3}}+4x^{\frac{1}{3}}+8x^{-1}.)$

(*Women only.*) Define interest and present worth. Find the present worth of £911 13*s.* 3*d.* due 5 years hence, at 3 per cent. simple interest. Ans. £792 15*s.*

18. (*Men only.*) As in First Year.

(*Women only.*) Find to five decimal places the difference between the square of 8·50163 and the cube of 3·712.
Ans. 21·13027.

19. (*Men only.*) Write out Euclid VI. 1.
Triangles and parallelograms which have equal altitudes are to one another as their bases.

Third Week.

1. As in First Year.

2. As in First Year.

3. If you were at the head of a school with a staff of one certificated assistant, two assistant teachers, and three pupil teachers, how would you divide the duty between them, and what share of the teaching would you yourself undertake? What do you consider should be the average number of scholars in such a school?

4. Comment on Spencer's observations on Poetry and the "Fine Arts," and on their relation to human life and well-being. *Or*
Enunciate and discuss the chief "Kindergarten" principles.

5. Write above B ♭ an augmented second, above G ♭ an augmented sixth, and above A a diminished fourth. *Or*

Rewrite the following passages, making a change of key by bridge notes wherever you think it best. Return to the original key by bridge-notes.

Key C (*a*) n s f t$_1$ l fe s n fe d' t n l f n r d
Key C (*b*) s d r f t$_1$ d s ta l f n r f ta l s l t d'

6. As in First Year.

7. As in First Year.

8. Analyse the following lines and parse the words in italics :—

(*Men only.*) As in First Year.

(*Women only.*)

"*O that* this too *too* solid flesh *would* melt,
Thaw and *resolve itself* into a dew!
Or that the *Everlasting* had not fixed
His canon 'gainst self-slaughter! O God! God!
How weary, stale, flat and *unprofitable*
Seem to me *all* the uses of this world!
Fie on't! ah *fie!* 'tis an unweeded *garden*
That grows *to seed.*"

9. (*Men only.*) As in First Year.

(*Women only.*) Describe the flora and fauna of New Zealand.

10. (*Men only.*) As in First Year.

(*Women only.*) Draw a physical map of Australia.

(11.) (*Men only.*) As in First Year.

(*Women only.*) Narrate the affairs of Ireland under the Tudors.

12. (*Men only.*) As in First Year.

(*Women only.*) For what events are the following years noted? 1499, 1513, 1534, 1536, 1555, 1572.

13. (*Men only.*) If a person walk along the boundary of a square paddock of 1,210 acres at the rate of 4 miles per hour, in how many minutes will he walk along one side? Ans. 20½ minutes.

(*Women only.*) A man invests a legacy of £3,500, half in the 2½ per cents. at 90, and half in an annuity which brings him in 7 per cent. on his outlay. Find his total income, neglecting brokerage. Ans. £171 2s. 2⅔d.

14. As for First Year.

15. (*Men only.*) As for First Year.

(*Women only.*) Cut out on paper the right half of a shirt for a boy nine years old. Give measurements.

16. (*Men only.*) Find, to two places of decimals, the edge of a cube whose volume is the same as that of a sphere 3½ feet in diameter. Ans. 2·82 ft.

(*Women only.*) How are coffee, milk, bread, beer, and butter sometimes adulterated, and by what means can such adulteration be most readily detected?

17. (*Men only.*) If $y=\frac{1-\sqrt{1-x^2}}{1+\sqrt{1-x^2}}$ and $z=\frac{1-\sqrt{1-y^2}}{1+\sqrt{1-y^2}}$ show that

$$z=\left\{\frac{1-(1-x^2)}{1+(1-x^2)^{\frac{1}{2}}}\right\}^2$$

(*Women only.*) What causes the prices of meat, fish, and vegetables to vary at different portions of the year? Give some instances showing at what times it is advantageous and when disadvantageous to purchase particular articles.

18. (*Men only.*) As in First Year.

(*Women only.*) Two partners start in business, one with £2,500, the other with £1,500, and borrow £1,200 at 4 per cent. At the end of a year they have gained a profit of 10 per cent. on the whole capital. What should each receive?

Ans. £295 and £177.

19. (*Men only.*) Write out Euclid VI. 3.

If any two straight lines are cut by three parallel straight lines, on the one are to one another as the intercepts on the other.

CORRESPONDENCE.

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A post will be saved by writing direct to DR. GEORGE BEACH, M.A. (*Examination Editor of 'Practical Teacher'*), STANLEY MOUNT, MACCLESFIELD.

ANSWERED BY ORDINARY POST.

W. W. P. (Crewe), T. H. R. (Dawley), W. A. W. (Harriseahead), J. H. S. (Child's Ercall), L. T. (Knutsford), J. H. W. (Saughall), O. E. M. (Godalming), A. E. M. (Northfleet), M. W. (Outwood), E. A. R. (Romsey), R. M. J. (Birmingham), A. J. D. (Eccleshall), J. M. (Brighton), W. W. (Arundel) two letters, H. W. (Halliwell), T. J. (Pontardulais), T. M. P. (Stoke), S. D. (Salford), J. L. G. (Birmingham), T. A. S. (Knaresborough), W. C. (Ulverston), A. L. S. (Ryde) two letters, H. W. B. (Alnwick), J. H. M. (Douglas), P. M. (Manchester), J. C. (House of Commons), D. J. H. J. (Cwmbach), J. H. W. (Saughall), J. H. H. (Birmingham), E. J. G. (Saundersfoot), A. E. D. (Hereford), H. M. (Oldham) (two letters), T. J. (Colchester).

C. R. (Madras).—Many thanks for your kind remarks. (1) Journal of Education. (2) Gladman's School Management. (3) No such journal in existence. (4) *Physiology*, Overend's, also Huxley's. (5) *Physiography*, Gregory's. (6) *Hygiene*, Newsholme's. (7) *Chemistry*, Collins' Science Series. (8) *Physics*, Newth. (9) *Book-keeping*, Chambers. (10) For children, Blackie's Science Series. (11) Blackie's Mathematical Wrinkles for Matriculation Students.

J. E. TETLOW (Oldham).—We have utilized your important communication, which will be of great value.

VIRGIL (Learning).—(1) Not in June; (2) No; (3) Persp. in May is more difficult; (4) Always state class.

NOTES ON ADVANCED AND HONOURS PHYSIOGRAPHY.

BY R. A. GREGORY, F.R.A.S.

Author of "Physical and Astronomical Geography" and "Elementary Physiography," Honours Medallist in Physiography, Oxford University Extension Lecturer.

THE topics treated in this month's notes are included under the following heads of the Physiography Syllabus :—Nebulæ—General idea of the distribution of stars and nebulæ, and of the dimensions of the sidereal system.

The Planets and Satellites of the Solar System compared with the Earth and Moon.—Masses, densities, rotation periods, atmospheres, temperatures, surface markings. Comets, and meteorites. On these matters read Lockyer's "Elementary Lessons in Astronomy," §§ 76–98, 29–32, 496–507, 251–320, or Young's "Lessons in Astronomy," §§ 377–387, 233–330. For revision and matters of physical geology read my "Elementary Physiography," Chapters XIX. and XX.

Though the Physiography Syllabus contains no reference to astronomical instruments, the questions set at the May examinations show that the examiners expect candidates to possess a knowledge of the means by which discoveries are made. On this account, a brief summary is here given of the chief facts relating to astronomical telescopes. Further information, if desired, will be found in Lockyer's "Lessons" §§ 448–486, or Young, §§ 402–419, and the optical principles underlying the construction of a telescope are explained in my "Elem. Phys.," pp. 101–104.

The Telescope was invented by Jean Lippershey in 1606. Galileo heard of the invention in 1609, and made an instrument for himself similar to a common opera glass.

The essential parts of a Telescope are (1) a convex lens, called the objective or object-glass to produce a real image; (2) a lens of much less focal length, or a combination of lenses, to magnify the image.

The illuminating power of a telescope depends upon the size of the object-glass. Increase in the size of object-glasses means increase of space-penetrating power. A lens ten inches in diameter collects 2,500 times more light than the naked eye; and one thirty-six inches in diameter grasps 32,000 times more than is collected by the eye-pupil.

The magnifying power depends upon the relative focal-lengths of the object-glass and the eye-piece. Variations of magnifying power are obtained by changing the eye-piece. Stars cannot be magnified. Bodies having measurable discs can be magnified, but there is a limit to magnification.

A reflecting Telescope utilises the fact that a concave mirror produces a real image like a convex lens. In Newton's form of

reflector the mirror reflects the image straight back to a piece of flat glass inclined at 45°, which sends it to the side of the tube. In Herschel's form of reflector the mirror is inclined so as to send the image to the side of the tube without a second reflection.

Large Telescopes.—The telescope of the Lick Observatory has an object-glass three feet in diameter. Russia possesses a 30-inch telescope. A 40-inch for Chicago is in course of construction. The largest reflector is at Birr Castle, Ireland. Diameter, six feet; length, sixty feet. Mr. Common, of Ealing, possesses a five-foot reflector. A ten-foot for Paris is in course of construction.

Mounting of Telescopes.—An alt-azimuth, or altitude and azimuth instrument, is a telescope mounted so that it is capable of moving vertically and horizontally. In construction it is similar to a surveyor's theodolite. If the base is tilted until it lies in the plane of the equator, that is, until it makes an angle with the horizon equal to the complement of the latitude of the place of observation, then the telescope, when perpendicular to the base, points to the celestial pole instead of the zenith. All large telescopes, to be of use, must be mounted on this "equatorial" principle. The telescope can then be made to follow automatically the motion of the celestial sphere, by giving the base an equivalent motion by means of a driving clock.

Meridian Instruments.—Some instruments are mounted so that they can only move up and down in a north and south plane—the plane of the meridian. Such are meridian instruments, and meridian circles; transit instruments, and transit circles. These are the instruments of precision of astronomical observatories. Each of these instruments consists of a telescope, having an axle at right angles to its length, and capable of turning in U or V-shaped bearings. This axle is adjusted horizontally in a true east and west direction, hence the telescope, being at right angles to it, always lies in a north and south plane. On looking through a transit instrument, five or more vertical and one or two horizontal lines are seen. The middle vertical line should be exactly in the meridian plane of the place in which the instrument is set up, so that a star which is covered by it is exactly on the meridian.

Use of the Transit Instrument.—Between two successive transits of the same star over the central cross-wire of a particular transit instrument, an interval of 23 hours 56 minutes 4 seconds elapses. This is a sidereal day. A clock keeping sidereal time shows 0 hours, 0 minutes, 0 seconds, when the "first point of Aries" is on the meridian, and the "Right Ascension" of any celestial object is the time indicated by the sidereal clock when that object is bisected by the central wire of a meridian instrument. To take an example: The sidereal time when Aldebaran crosses the meridian should be 4 hours 27 minutes 33 seconds, therefore the right ascension (R.A.) of this star is 4 hours 27 minutes 33 seconds. If the sidereal clock indicate 4 hours 26 minutes 0 seconds when Aldebaran is transiting, then it is 1 minute 33 seconds slow; hence by observations of the transit of a star of known right ascension, a sidereal clock can be regulated. Now there is a constant relation between sidereal and mean time, so that one is convertible into the other. If, then, we observe a known star cross the meridian, we know what the sidereal time ought to be, and, by means of conversion tables, we find what the mean time ought to be. A mean-time clock or watch can thus be regulated by observations with a transit instrument. By measuring the angular distance from the celestial equator of an object in transit, the declination is found.

Meridian and Equatorial Telescopes.—The following comparison shows the relative advantages of equatorial telescopes and transit instruments, or meridian telescopes:—

Transit or Meridian Instruments	*Equatorial Telescopes*
Can only move up and down in the plane of the meridian.	Can be pointed to any part of the sky.
Used for accurately determining positions of celestial bodies.	Used for investigating the nature of celestial bodies.
Can only be used to observe bodies as they transit.	Can be used to observe bodies continuously.
The axis of movement is horizontal.	The axis of movement is elevated to an angle equal to the latitude of the place of observation.

Nebulæ.—There are a number of hazy patches known as nebulæ, the feeble luminosity of which indicates a low temperature. Tait (1871) suggested that nebulæ are "clouds of meteorites." Prof. Lockyer's spectroscopic observations give support to this view: "Hence, in all probability, a nebula and a comet are of identical constitution, and a comet is merely a nebula which has become entangled in the solar system." The evidence as to the low temperature of nebulæ is as follows: (1) A small nebula has the appearance of a comet at aphelion; (2) the spectrum of nebulæ is that given by comets when at a considerable distance from the sun, and therefore at a low temperature; (3) new stars, as they have diminished in intensity, and therefore, in all probability, decreased in temperature, have been found to assume the spectrum of nebulæ. Notable examples: The new stars of 1876 and 1892, viz., Nova Cygni and Nova Aurigae.

Spectra of Nebulæ.—Dr. Huggins (1864) found that nebulæ have spectra of bright lines. Four bright lines are conspicuous in the visible spectrum, and as many more have been seen by acute observers. Some nebula (*e.g.* nebula of Andromeda) exhibit bright bands due to carbon in their spectrum, and not bright lines. The brightest line in the visible spectrum of nebulæ was at first supposed by Dr. Huggins to be due to nitrogen. Prof. Lockyer (1887) suggested that the line is due to magnesium. The evidence as to the magnesium origin is as follows: (1) One of the first metallic elements which shows itself spectroscopically when meteoritic fragments are slowly raised in temperature is magnesium. (2) The chief nebular line has been seen by some observers to have the same appearance as the magnesium line. (3) The magnesium line is nearly, if not quite, identical in position with the nebular line. Prof. Lockyer's suggested origin has not been generally accepted, but it has given the *coup de grâce* to the widely-taught idea that the characteristic badge of nebulæ is due to nitrogen. On this point Prof. Young remarks, "it is now certain that whatever it may be, nitrogen is not the substance." The photography of the spectra of nebulæ has revealed many new lines. On a photograph taken under Prof. Lockyer's direction in 1890, twenty-eight lines occur, some of which appear to have their origins in magnesium, manganese, and carbon, while hydrogen lines are certainly present.

Forms of Nebulæ.—Some nebulæ are irregular in form, and cover an enormous area of sky. Others are more or less regular in outline. Nebulæ are classified according to their forms in the following manner: (1) Irregular nebulæ. An example of this type is the great nebula of Orion. (2) Annular or ring nebula. Example: the ring nebula in the constellation Lyra. (3) Spiral nebulæ, in which nebulous matter is distributed in spirals or concentric rings. Examples: the spiral nebula in Canes Venatici, and the great nebula of Andromeda. (4) Planetary nebulæ. These show a more or less circular disc of nearly the same brightness in all its parts. (5) Globular nebulæ are similar to planetary, but their discs are surrounded with halos of nebulosity. (6.) Nebulous stars, in which a bright point is surrounded by a wide halo of nebulosity. (7) Cometic nebulæ, in which a fan-shaped stream of nebulosity has a bright point at the apex. (8) Double nebulæ. All these forms merge into one another, and probably represent different stages of growth.

Advantages of Photography.—The photographic plate can accumulate feeble light indefinitely, and so bring into view objects too faint to be seen directly. It is also sensitive to vibrations which are unable to excite the sense of sight. Thousands of stars can have their positions and brightness accurately recorded in a few minutes upon a photographic plate, whereas the work would take many years of visual observation.

Lunar Photography began in 1839; but the first results of scientific importance were obtained by Dr. Draper in America in 1840. Warren de la Rue produced some fine pictures in England (1852–57), Rutherford (1858), and Draper (1862) in America. Recent workers are:—Holden (Lick Observatory), MM. Henry (Paris Observatory), Mr. Russell (Sydney Observatory). Photographs of the Moon are useful for determining whether any changes take place in lunar formations.

Photographs of the Sun are taken with two chief objects. (1) In a continuous series, in order to furnish information with regard to the changes, periodicity, and distribution of sun spots and faculæ. (2) To furnish information with regard to changes in the structure of the photosphere.

Photographs of Nebulæ.—Dr. Draper photographed the Orion nebula (1880). Dr. Common made important advance in this direction (1883). MM. Henry photographed nebulosity round stars in the Pleiades (1885). Dr. Roberts showed that the whole group is immersed in nebulosity (1886), and afterwards followed with marvellous photographs of the Orion and Andromeda nebulæ, his pictures of the former nebula showing double the nebulosity which appears on any other. Mr. Russell, of Sydney, Dr. Gill at the Cape, and Dr. Max Wolfe have recently photographed masses of nebulous matter previously unknown.

Photographs of Stars.—Dr. Roberts has photographed 16,000 stars in an area of four square degrees. In the same sky-space Argelander, by means of a three-inch telescope, saw about 200 stars. Mon. Henry has photographed several thousand stars within an area of about six square degrees, down to the sixteenth magnitude, that is, beyond the range of visibility afforded by the best telescopes, under the Paris sky.

Photographic Map of the Stars.—Rutherford suggested star-charting by photography (1860). Dr. Gill (1882) and the Henry brothers (1884) proved that the scheme was practicable. An inter-

national astro-photographic congress met at Paris in 1887, and decided that "the progress achieved in astronomical photography imperatively demands that the astronomers of our day undertake in concert the description of the heavens by photographic processes." The requisite telescopes have been constructed, and the work is now well under weigh. The observatories taking part are Greenwich, Rome, Catania, Helsingfors, Potsdam, Oxford, Paris, Bordeaux, Toulouse, Algiers, San Fernando, Tacubaya, Santiago, La Plata, Rio de Janeiro, Cape of Good Hope, Sydney, and Melbourne. Each observatory has a particular portion of the sky allotted to it.

Photographic Determination of Stellar Parallax.—Professor Pritchard, Director of Oxford University Observatory, has applied photography to the determination of the parallaxes of some thirty stars, this being a greater number than that attempted by any other astronomer. About twenty photographs are taken of the star, of which the parallax is desired, and the region round it. Measurements of the relative positions of the stars upon the pictures then give the dimensions of the parallactic eclipse of the one under investigation.

The Photography of Spectra.—Much has been done in the photography of the spectra of the sun, stars, and nebulæ. Lockyer instituted the photography of comparison spectra of the sun and elements. He has in recent years done a large amount of work in the photography of stellar and nebular spectra. Pickering, in America, has photographed and catalogued the spectra of 10,000 stars. Vogel, of Potsdam, has photographed the spectra of stars side by side with the spectra of hydrogen and iron, in order to determine "motion in the line of sight," by measuring the displacement of the star lines with respect to lines of these elements. From a determination of the motions of fifty-one stars he finds as follows :—

Greatest velocity of recession (Aldebaran) = 30·2 miles per sec.
" " approach (γ Leonis) = 24 " "
Number of stars with velocities of recession greater than 10·4 miles 7
" " " approach " 11

Distribution of Stars.—Observations show that the Milky Way is composed of an immense number of small stars. From this it is evident that by far the greater number of stars are congregated near the Milky Way. Herschel counted the stars visible in the field of view of the same telescope directed to different parts of the heavens, and the following table shows the average result for several galactic latitudes (latitudes counted from the equator of the Milky Way):

Distance from Gallactic Equator.	Average Number of Stars Visible.
0°	122
15	30
30	18
45	10
60	6
75	5
90	4

It appears, therefore, that there is a rapid decrease of stars in passing from the galactic equator towards the galactic poles.

Distribution of Nebulæ.—The regions, rich in stars, are poor in nebulæ, "as if," says Young, "the stars had somehow used up the substance of which the nebulæ are made." Nebulæ are most numerous away from the Milky Way, and are exceedingly plentiful in the constellation Virgo.

Dimensions of the Sidereal System.—Herschel assumed "that the stars of each succeeding magnitude, beginning from the first, are one with another further from us than those of the magnitude immediately preceding it." A theory as to the structure of the sidereal universe was built upon this assumption. It is, "the stars of our firmament, instead of being scattered in all directions indifferently through space, form a stratum of which the thickness is small in comparison with its length and breadth, and in which the earth occupies a place somewhere about the middle of its thickness." According to this theory, the Milky Way is a projection of the stratum of stars upon the celestial sphere. At the galactic poles we look through a much smaller thickness, so a much smaller number of stars are seen. Many of Herschel's conclusions are now known to be erroneous; nevertheless it seems probable that "the great majority of stars we see are included within a space having, roughly, the form of a rather thin, flat disc, like a watch, with a diameter eight or ten times as great as its thickness, our sun being not very far from its centre."—(Young.)

Planets and Satellites.

Mercury, diameter 3,000 miles, is the smallest of the larger planets. Remarkable as having the least mass and greatest density, in the latter respect being like the element mercury. Time required to make an axial rotation doubtful. Schiaparelli (1889) published observations indicating that the rotation period is the same as the period of revolution, viz., 88 days. Many astronomers favour old period of about 24 hours. Atmosphere not so extended nor so dense as that of the earth. Spectroscope reveals existence of water vapour. Mercury, being the nearest planet to the sun, receives the most intense light and heat. Surface markings ill-defined and difficult to see.

Venus, next to the Sun and Moon, is the most brilliant celestial object. It goes through phases like the Moon and Mercury. Diameter 7,710 miles (that is, slightly less than the earth's diameter). Mass, about four-fifths that of the earth. Density, compared with the earth, 0·86. Rotation period doubtful. Schiaparelli makes it equal to the period of revolution, viz., 224 days, but recent observations go to support a period of nearly 24 hours. Atmosphere is about twice as dense as that of the earth, and undoubtedly contains water-vapour. Intensity of solar radiation at distance of Venus about double that received by the earth. Surface markings consist of faint greyish spots and white patches, known as ice-caps, at the poles. Like Mercury, Venus is occasionally seen as a black spot crossing the sun's disc. A "transit of Venus" is useful for determining solar parallax.

Mars is the first planet outside the earth's orbit. Diameter 4,200 miles, mass one-tenth, and density three-quarters that of the earth. Rotation period (known to a fraction of a second) 23 hours 37 minutes 22·7 seconds. Atmosphere very slight, but spectroscope reveals water-vapour in it. Surface markings are nearly all permanent, and not atmospheric objects. They are far better known than those of any other planet, and are classified into "(1) white patches, two of which are specially conspicuous near the planet's poles, and are generally supposed to be masses of snow and ice; (2) patches of bluish-grey or greenish shade, covering about three-eighths of the planet's surface, and generally supposed to be bodies of water; (3) extensive regions of various shades of orange and yellow, covering nearly five-eighths of the surface, and interpreted as land."—(Young). In addition, straight streaks, known as channels or "canals," were discovered by Schiaparelli in 1877, and some of them were seen doubled by the same observer in 1882. Recent observations confirm the existence of a few streaks of this character. The two satellites of Mars were discovered in 1877; their distances are 5,800 and 14,600 miles respectively. The inner of the two is remarkable in the fact that it revolves round Mars in less time than the planet's period of rotation, its revolution period being 7 hrs. 39 mins. A consequence of this is that the satellite rises in the west and sets in the east of the Martian horizon.

The Asteroids.—The largest of these small bodies cannot be more than 300 miles in diameter, and some are no more than 10 miles. The total mass is about one-fourth that of the earth, and the total bulk of the 370 at present known is about $\frac{1}{3000}$ that of the earth. Nothing is known concerning the physical features, such as surface markings, atmospheres, &c.

Jupiter, mean diameter 86,500 miles; shows considerable flattening at the poles. Mass (known with great accuracy) 316 times greater than the mass of the earth. Density, compared with the earth, 0·24, that is, about the same as the density of the sun. Rotation period, 9 hours 55 minutes. It is this extremely rapid rate of rotation which causes the large polar compression. Atmosphere very dense and deep; possibly the planet is semi-fluid throughout, or it may consist of a small solid nucleus surrounded by a very thick atmospheric layer. Temperature comparatively high. Surface markings very distinct but variable. Belts of cloud lie above and below the equator, and more or less parallel to it. These are covered with numerous delicately-tinted spots and markings. The "red-spot" was noticed in Jupiter's southern hemisphere in 1878. It is constantly elliptical in outline, but has changed its colour from brick-red to a light tint differing very little from the surrounding portions of the planet's disc. The spot is probably a depression in the planet's atmosphere, for at times layers of cloud overlap and partially obliterate it. Jupiter has five satellites; four were discovered by Galileo (1610), and a much fainter object by Barnard (1892). This new moon, or fifth satellite, of Jupiter, revolves round the planet twice in one of our days. It is about 100 miles in diameter. The four old satellites have diameters ranging from 2,100 to 3,550 miles.

Saturn.—Mean diameter 73,000 miles. Polar compression greater than any other planet. Mass, 95 times that of the earth. Density, one-eighth the density of the earth, and much less than other planets. Rotation period, about 10¼ hours. Atmosphere, like the atmosphere of Jupiter, consists of dense gases and vapours. The spectrum of each of these planets shows, in addition to the lines due to reflected sunlight, several unexplained dark red bands. Saturn, like Jupiter, possesses inherent heat, though its temperature is probably not so high. Surface markings consist of a number of belts of cloud more or less parallel to the equator. Three flat concentric rings surround Saturn in the plane of its equator. The inner

edge of the nearest ring is about 10,000 miles above the planet's surface, and the width of the ring-system is 37,000 miles, that is, about the same as Saturn's equatorial radius. Thickness of the ring not uniform; greatest thickness about 200 miles. The rings have a constant inclination of about 28° to the plane of the ecliptic. (This is analogous to the constant inclination of the earth's equatorial plane.) In consequence the rings present different aspects: sometimes they are seen edgeways (this happened in 1892), and at other times the illuminated side is seen "full-face." Experiment to illustrate these phases: Place lamp upon table to represent the sun. Walk round it, and obtain someone to carry a plate round slantingly in a path outside yours; the plate always remaining parallel to itself. The appearance of the illuminated portion will be found to differ in a similar manner to Saturn's rings. The rings cannot be solid, neither can they be liquid, for tidal action would soon break them up. They are made up of an infinite number of separate particles—meteorites—revolving in the plane of the planet's equator. Saturn has eight satellites. Titan—the largest—has a diameter of about 3,500 miles, the others have diameters varying from 500 to 2,000 miles.

Uranus.—Discovered by Herschel (1781). Diameter 32,000 miles. Mass, fifteen times greater than the mass of the earth. Density, compared with the earth, 0·22. Rotation period unknown. Atmosphere very probably dense and deep. The spectroscope reveals intrinsic heat. Surface markings very indistinct. Four satellites, the third of which, counting from the planet, has an orbit of about the same size as the orbit of the moon. Diameters doubtful. The plane of the orbits of the satellites is almost perpendicular to the ecliptic. The satellites revolve in a retrograde direction, that is, in the same direction as watch-hands, if viewed from a point north of the ecliptic.

Neptune.—Discovered by mathematics (1846). Uranus did not move in its calculated path. Inference, an unknown body was disturbing it. Position of unknown body calculated by Adams and Leverrier from the differences between the observed and predicted places. The latter computor directed Galle where to point his telescope, and Neptune was discovered. Diameter 35,000 miles. Mass, eighteen times greater than the earth's mass. Density, 0·2 compared with the earth. Rotation period unknown. Atmosphere probably dense and deep. Temperature high, like Uranus. Both these planets are somewhat self-luminous. No visible surface markings. One satellite known; its diameter and orbit being like that of our Moon. The orbit of the satellite is inclined 35° to the ecliptic (the inclination of the Moon's orbit is only 5°) and the motion is retrograde like that of the satellites of Uranus.

The Moon.—Diameter 2,160 miles. Mass, one-eightieth the mass of the earth. Density, compared with the earth, 0·61. Rotation period the same as period of revolution, viz., 27⅓ days. No atmosphere, evidenced by the following facts: (1) When the moon passes in front of a star, the star disappears instantaneously behind it, and retains its full brightness up to the moment of disappearance. (2) All parts of the moon appear equally sharp and well-defined without any haziness. (3) No clouds are ever seen. Temperature of the part of the Moon receiving the Sun's rays, about that of water when it freezes; when the Sun's rays are withdrawn, the temperature is some hundreds of degrees below this.

Lunar formations are classified into (1) maria or seas. These are the dark patches which are seen upon the moon, and were originally supposed to consist of water. There is reason to believe that they are the beds of extinct seas and oceans. (2) Craters and walled plains. The normal Lunar crater consists of a nearly circular ridge surrounding one or more conical peaks near the centre. The diameters of these rings vary from five to more than 100 miles. There seems to be every gradation between small craters and extensive plains surrounded by ridges, walls, or ramparts. The origin of the craters and plains is doubtful. Volcanic disturbances furnish the simplest explanation of these formations, but there are several difficulties in the way of its acceptation. (3) Lunar mountain ranges. On the earth the mountains, as a rule, run in ranges, and it is exceptional to find them isolated. The reverse is the case on the moon. (4) A number of valleys or rills, some twenty miles wide and a couple of hundred miles long, others much smaller, both in length and breadth. These probably represent the beds of extinct rivers. (5) Nearly a thousand clefts running across craters and valleys and anything else in their way. (6) Bright streaks or rays diverging from a few of the craters. The crater known as Tycho, near the south edge of the moon, possesses the most conspicuous of these ray-systems. At the time of full moon the markings are very plainly visible, giving Tycho the appearance of the top of a peeled orange.

Comets and Meteorites.

Parts of a Comet.—Faint comets, visible only by means of a telescope, usually have the appearance of a small patch of mist. Comets bright enough to be seen with the naked eye are made up of (1) the hazy coma or head; (2) the tail, which is generally directed away from the sun; (3) the nucleus, usually a bright central spot but sometimes consisting of a number of such spots; (4) jets and envelopes of luminous matter which appear to be emitted by the nucleus on the sunward side, and then to be driven back to form the tail.

Sizes of Comets.—The dimensions of comets are constantly changing. Average diameter of head about 40,000 miles. Diameter of the head of the great comet of 1811, one and quarter millions of miles; the head of the comet of 1858 was 250,000 miles in diameter. Tails of naked-eye comets vary in length from five to fifty millions of miles. The nucleus varies from about 100 miles to 5,000 miles in diameter.

Masses of Comets.—Though comets are so large, their masses are extremely small. Evidence on this point is furnished by the fact that members of the solar system are not disturbed when comets approach them, whereas the comet's orbit is always changed by such an encounter.

Density of Comets.—A large volume and a small mass necessarily means a small density (density = mass ÷ volume), taking the comet as a whole. The fact that stars are seen through comets without suffering any displacement testifies to the extreme tenuity of these bodies. The head of a comet very probably consists of a number of solids, the density of each of which is comparatively high; but when the total mass is divided by the total volume, the resulting density is extremely low.

Comets' Tails.—The vapours spurted out from a comet's nucleus are acted upon by two forces: (1) Gravitation tends to make them fall towards the sun; (2) An unknown force, probably electrical, drives them away. The form assumed by the vapours which make the tail therefore represents the resultant of the two actions. Professor Bredichin has classified the tails of comets according to their shape, and has calculated the ratio which gravitational attraction bears to the repellant action in the case of each. The results are as follows:—

Class I. Straight or hydrogen tails. Repellant force = 12 times attractive force; velocity of particles leaving nucleus, 150,000 feet per second.

Class II. Plumy or carbon tails. Repellant force = attractive force; velocity of particles, 3,000 feet per second.

Class III. Strongly-bent or iron tails. Repellant force about one-fifth of attractive force; velocity of particles, 1,000 feet per second.

Meteorites.—A shooting star is a particle of matter which has been attracted into the earth's atmosphere and rendered luminous by the friction put upon it. Occasionally the amount of heat developed is insufficient to vapourise the entire fragment, and a portion falls to the ground as a *meteorite.* Velocity of meteorites entering the earth's atmosphere, 10 to 45 miles per second. Schiaparelli has shown that if a ball 8 inches in diameter and 32 lbs. weight enter the atmosphere with a velocity of 45 miles per second, on arriving at a point where the pressure is still only $\frac{1}{100}$ that at the earth's surface, its velocity would have been reduced to 3½ miles per second. The energy thus lost, if converted into heat, would be sufficient to raise 198,400 lbs. of water from 32° to 212° Fahr.

Number of Shooting Stars.—Mean number of shooting stars seen at one place by one observer between midnight and 1 a.m. = 14. Number seen above one horizon by a group of observers, in the same time = 84. Number which would be visible over the whole earth = 10,000 times 84.

Therefore, mean daily number = $84 \times 10{,}000 \times 24 = 20{,}000{,}000$ (about). Including telescopic meteors, the number is increased to 400,000,000.

Professor Newton has shown that in a space = volume of the earth there are 30,000 meteorites. Therefore mean distance between the individuals = 250 miles.

Classification of Meteorites.—Meteorites are arranged into three classes, viz.: (1) Siderites, which consists mainly of iron; (2) Siderolites, containing large proportions of iron and stony matter; (3) Aerolites, consisting almost entirely of stony matter. These classes merge into one another.

Elements in Meteorites.—About one-third of the known chemical elements have been found in meteorites. The commonest constituents are iron, nickel, phosphorus, sulphur, carbon, oxygen, silicon, magnesium, calcium, aluminium, hydrogen, and nitrogen. Hydrogen, some of the compounds of carbon and nitrogen occur occluded in meteorites, that is, enclosed between the solid particles. All the other elements occur in combination. Siderites consist almost entirely of an alloy of iron and nickel.

Minerals in Meteorites.—A number of the minerals in meteorites are unknown in terrestrial mineralogy. Compounds are found identical with olivine, enstatite, bronzite, augite, anorthite, troilite, and other terrestrial minerals. Though quartz is so abundant in the earth's crust, it does not occur in meteorites. It is often difficult to

distinguish meteoric "irons" (siderites) from terrestrial masses. Large masses found at Ovifak (Greenland), and supposed to be meteorites, are now known to have been produced by the weathering of basaltic rocks containing nickeliferous iron. Rocks similarly constituted have been discovered in New Zealand. "Some assert that the basalt and the nickel-iron have been expelled together from great depths below the earth's surface, while others consider that the nickel-iron is due to the reduction of the basalt by its passage through beds of lignite and other vegetable matter."

Meteor Showers.—Showers of shooting stars are occasionally seen. It is observed that the meteors of a particular shower radiate or diverge from a particular spot in the sky, termed the radiant or radiant point. This is merely an effect of perspective. All the meteoritic particles travel in practically parallel paths, and the radiant is the "vanishing point" of these paths. Meteors having their radiant in the constellation Leo are termed Leonids, those which diverge from Andromeda are Andromdes, and the meteors of Perseus are Perseids. Meteor showers occur periodically. Perseids are seen during August in every year. Brilliant displays of Leonids have been observed about the middle of November every thirty-three years since 902 A.D. From these facts it appears (1) that the Perseid meteors belong to a ring of particles surrounding the sun, and crossed by the earth in August, and (2) that the Leonid meteors form a more or less concentrated swarm revolving round the sun in thirty-three years in an orbit which crosses the orbit of the earth.

Connection between Comets and Meteorites.—Five comets are known to move in paths identical with those of swarms of meteorites. The Persieds have the same path as a comet seen in 1862, and the Leonids correspond to Tempel's comet of 1866. This leads to the belief that all comets are swarms of meteorites. The idea is supported by Professor Lockyer's investigations of the spectra of comets. Three chief causes determine the temperature of a swarm of meteorites in our system, viz., (1) the distance of the meteorites from the sun; (2) number of meteorites scattered along the orbit; and (3) the velocity of meteorites round the common centre of gravity. A number of meteoritic particles heated to different temperatures in vacuo in a laboratory would probably emit light of the same quality as that of a swarm of similar particles subjected to varying temperatures in space. If, then, a comet is a swarm of meteorites, it is coolest at aphelion—at its greatest distance from the sun—and increases in temperature as the sun is approached, and the variation should have, roughly, the same sequence as that found in laboratory experiments. Professor Lockyer finds that this is the case, hence the results obtained from a discussion of the spectra of comets and meteorites, as well as the orbital identities go to show that "comets and meteorites are one and the same phenomenon."

Changes in a Comet.—These changes are telescopic and spectroscopic. To begin with the former, a comet at aphelion looks like a patch of haze, and can only be distinguished from a nebula by its motion. As it approaches the sun, the central portion begins to brighten; a nucleus is then formed, and from it jets of luminous material burst out towards the sun. Concentric envelopes enclose the nucleus on the side towards the sun, and bend back to form the tail. This appendage usually increases in size until a few days after the comet has passed its point of nearest approach (perihelion point). The phenomena afterwards decrease in intensity until the comet again assumes the appearance of a patch of mist. The general sequence of spectroscopic changes, both in nebulous swarms and comets, is stated by Professor Lockyer to be as follows:—

(1.) Radiation of magnesium at low temperature.
(2.) Radiation of carbon and manganese flutings.
(3.) Absorption of lead and manganese flutings.
(4.) Line radiation and absorption.

Halley's Comet is remarkable as being the first shown to move in a closed orbit. Halley found that the elements of the comet of 1682 were the same as those of comets seen in 1607 and 1531, the interval between each of these being about 76 years. He therefore predicted a return of the comet in 1758. The prediction was fulfilled, hence periodicity was established. Next return, 1910.

Encke's Comet is remarkable as being the first "short period" comet discovered (1819), period 3½ years, which decreases, however, by about 2½ hours every revolution. This is accounted for by supposing that the comet has to pass through some medium which resists its motion. Diminution of centrifugal tendency results in comet describing a smaller orbit, so the journey is completed in a shorter time. The result of the resistance to motion is thus an apparent quickening or acceleration. Next return, 1894.

Biela's Comet is the second short-period comet discovered (1826). It was seen to be double in 1846, and again in 1852. In 1866 it did not appear at all, though it was due. In 1872 it was again conspicuous by its absence, but a shower of shooting stars occurred when the earth was passing near the place where the comet ought to have been. Similar conditionings resulted in other meteor showers in 1885 and 1892. It is therefore believed that the meteoritic particles which produced the showers represent the result of the breaking up of Biela's comet. On this account the meteors of the end of November, which have their radiant in Andromeda, are know as Bielids as well as Andromedes.

Honours Note.

Variation of Latitude.—In recent years considerable attention has been drawn to the fact that the latitude of a place, as determined by observation of stars, is subject to a periodic variation. The difference in the observed positions of stars from which the latitudes were deduced could be produced by (1) a real periodic change in the direction of the earth's axis or (2) periodic variations of atmospheric conditions causing differences in the amount of atmospheric refraction. To determine whether the earth's axis of rotation really undergoes a periodic shift, the International Gerdetic Union sent an astronomical expedition to Honolulu, which is nearly 180° west of Berlin, for the purpose of making a twelve months' series of observations of latitude corresponding to twelve months' analagous observations made at Berlin, Prague, and Strasbourg. The observations began on June 1, 1891, and the results were published at Berlin in October, 1892. "They prove beyond all question that between May, 1891, and June, 1892, the latitude of each of the three European observations was at a maximum, and of Honolulu a minimum, in the beginning of October, 1891: that the latitude of the European observations was at a minimum, and of Honolulu a maximum, near the beginning of May, 1892: and that the variation during the year followed, somewhat approximately, simple harmonic law, as if for a period of 385 days, with range of about ¼ second above and below the mean latitude in each case. This is just what would result from motion of the north and south polar ends of the earth's instantaneous axis of rotation, in circles on the earth's surface of 7·5 metres, [8·2 yards] radius, at the rate of once round in 385 days."

"Sometime previously it had been found by Mr. S. C. Chandler, that the irregular variations of latitude which had been discussed in different observatories during the last fifteen years, seemed to follow a period of about 427 days, instead of the 306 days given by Peter's and Maxwell's dynamical theory, on the supposition of the earth being wholly a rigid body. And now, the German observations, although not giving so long a period as Chandler's, quite confirm the result that whatever approximation to following a period there is in the variations of latitude, it is a period largely exceeding the old estimate of 306 days." This fact goes against the theory that the earth is an absolutely rigid body, and favours the idea that the earth is an elastic body, and therefore subject to deformations. Professor Newcomb has decisively shown that from 1865 to 1890 the variations of latitude were much less than in 1890, indicating that a sudden augmentation took place. As to the cause of the differences of latitude, Lord Kelvin remarked at the anniversary of the Royal Society, "When we consider how much water falls on Europe and Asia during a month or two of rainy season, and how many weeks or months must pass before it gets to the sea, and where it has been in the interval, and what has become of the air from which it fell, we need not wonder that the distance of the earth's axis of equilibrium of centrifugal force from the instantaneous axis of rotation, should often vary by five or ten metres in the case of a few weeks or months." The facts in this note are summed up as follows, (1) The latitude of a place decreases and increases by one-quarter of a second of air in a period of 385 days. (2) The change is due to a real shift in the direction of the earth's axis, and not the result of differences of refraction. (3) The cause of the shift of the axis of rotation is probably the movement of large quantities of water on the earth's surface.

Questions set at the May Examination.

1. Give an account of the appearances, observed in the telescope, on the surface of the planet Mars. (1891.)

2. State the telescopic and spectroscopic changes observed in comets as they approach perihelion, and the causes which produce them. (Hon. 1891.)

3. What is a comet, and what are the changes produced in it during its journey round the sun? (Hon. 1890.)

4. What are the facts which lead us to suppose that the moon has no atmosphere? (1890.)

5. Describe the planet Saturn. (1887.)

6. State what is known about the satellites of Mars. (Hon. 1881.)

7. What are the views at present concerning the nature of Saturn's rings, and what are the facts on which these views are based? (1880.)

8. State the probable climatic conditions of Mars and Jupiter. (Hon. 1880.)

9. Describe the composition of the different classes of meteorites, and compare it with that of the earth's crust. (Hon. 1879.)

10. State the chief applications which are now made of photography in astronomical observations. (Hon. 1892.)
11. State what you know about nebulæ. (1889.)
12. Describe some recent results obtained by means of long-exposure photographs of the heavenly bodies. (Hon. 1889.)
13. What is the use of a transit instrument? (1887.)
14. Describe the various forms of nebulæ. (1888.) [The forms described should be irregular, spiral and elliptic, planetary, globular and cometic.]
15. Compare the atmospheres of the major planets. (Hon. 1886.)
16. Describe the construction of the achromatic object-glass. (1884.)
17. What is the difference between a refracting and a reflecting telescope? Describe the construction of both. (1883.)
18. State what you know about the surface of the planet Mars. (Hon. 1882.)
19. What is known regarding the chemical nature of comets? (Hon. 1882.)
20. How has the connection between comets and luminous meteors been established, and what is the nature of the connection? (Hon. 1879.)
21. Describe a transit-circle and its uses. (1879.)

Questions set at the December Examination.

1. What are comets? (1888.)
2. Describe a comet, and say what the spectroscope has taught us regarding the nature of those bodies. (1882.)
3. How does a transit instrument enable us to keep a mean-time clock right? (1889.)
4. What are the views held as to the origin of comets' tails? (Hon. 1889.)
5. Describe the mode of occurrence of metallic iron in meteorites and in certain rocks belonging to the earth's crust. (Hon. 1889.)
6. How is a transit-circle used, and what information does it furnish? (1888.)
7. State what you know concerning the connection between comets and meteorites. (1885.)
8. How are observations made with the transit-circle, and what is their object? (1885.)
9. Describe the construction of both a reflecting and refracting telescope. (1884.)
10. What is the theory of the formation of Saturn's rings? (1884.)
11. Describe the spectra of the nebulæ. (Hon. 1889.)

Physical Geography Questions.

1. What is meant by sub-aerial denudation, and what are the chief agents in it? (May, 1887.)
2. Explain the methods by which the quantity of material carried down by rivers in suspension and solution respectively can be determined. How may this be made to gauge the rate of sub-aerial denudation within the river basin? (May, 1880.)
3. Describe observations by which the rate of movement of glaciers has been determined, and state the results which have been arrived at by these observations. (May, 1883.)
4. Compare the action of rain and rivers in producing the features of the earth's surface. (December, 1889.)
5. What is meant by denudation? How would you prove to your class that denudation is taking place at the present time? (December, 1884.)
6. What are the chief facts known concerning the nature of the movement of glaciers, and the rate at which this movement takes place? Describe the observations by which these facts have been discovered. (December, 1880.)
7. State the points of resemblance and of difference between the glaciers of the Alps and those of the Arctic regions. (May, 1892.) [Arctic glaciers are much larger, and flow much faster than Alpine ones. Both kinds resemble one another in the formation of morains, though not in the quantity of moraine matter.]
8. Explain the action of plants and animals upon the constituents of the atmosphere. (May, 1880.)

Questions on the Subjects of the Notes.

1. Describe the planet Jupiter.
2. Describe the planet Mars.
3. Give an account of the changes which a comet undergoes in passing from aphelion to perihelion.
4. How are the changes undergone by a comet in passing from aphelion to perihelion explained by the meteoritic hypothesis?
5. Compare the transit instrument with the equatorial telescope.
6. Describe an equatorial telescope.
7. What are the chief observations made with the transit instrument?
8. State what you know concerning the periodic variation in the latitude of the same place, and the possible causes which produce it.
9. Upon what does the illuminating and the magnifying power of a telescope depend?
10. What grounds are there for believing that the chief nebular line is due to magnesium vapour?
11. Give an account of the recent advances that have been made in connection with the motion of stars in the line of sight.
12. State what you know concerning the distribution of stars and nebulæ.
13. Write accounts of the planets Uranus and Neptune.
14. Enumerate the chief lunar formations.

Corrections.—At the bottom of the second column on page 497 of the March number of the PRACTICAL TEACHER, the "flame" of the ecliptic is printed in two places instead of the ecliptic "plane."

SCHOLARSHIP FRENCH.

BY W. T. THOMPSON, B.A. (LOND.).

Honours at Matriculation, with Marks qualifying for Third Prize; First Class French Honours, with Marks qualifying for the Prize; Second Class German Honours; Co-Director of the Birkbeck Training Classes.

NOTES AND VOCABULARY TO "LA JEUNE SIBÉRIENNE."

[*N.B.*—*The rules referred to will be found in the* PRACTICAL TEACHER *for September*, 1892.]

45.13.—*propre*, adj., m. and f., sing.; own. This is its meaning when *preceding* a noun.

45.14.—*dès lors*, from then; from that moment.

45.17.—*s'était proposé*, lit. "had proposed *to* herself." Translate "had intended." We know *se* to be ind. obj. here, as if it had been dir. obj. the past part. would have been *proposée* by Rule E (1).

45.19.—*précédemment*, adv., previously. Adjs. in *ant* and *ent* change the *nt* into *m* when the adverbial termination *ment* is added.

45.21.—*Cru*, past part. of *croire*, to believe.

45.24.—*s'était promis*, had promised to herself. See note on 45.17.

45.28.—*renferment*, pres., ind., 3 pl. of *renfermer*, enclose, contain.

45.28.—*s'arrêter*, engage for herself. See note on 40.45.

45.29.—*avenir*, noun, masc., sing., future. From *à venir*, to come, *i.e.*, the-time-to-come.

45.31.—*reconnu*, past part. of *reconnaître*, recognise.

45.34.—*le promit*, promised it, *i.e.*, to choose the convent, etc.; *promit*, pret., 3 sing. of *promettre*, promise.

45.36.—*d'en faire le vœu formel*, to make the formal vow to do so (*en* lit. of it=to do so).

45.37.—*sais*, pres., ind., 1 sing. of *savoir*, to know.

45.38.—*exige*, pres., ind., 3 sing. of *exiger*, exact, require.

45.41.—*pourra*, fut., 3 sing. of *pouvoir*, be able.

45.41.—*s'y opposer*, lit. to oppose himself to it. Translate "to oppose it."

46.1.—*demeurer*, vb., inf., to stay.

46.3.—*se rendre à*, betake herself to.

46.4.—*se ressentit de*, felt the effects of; *se ressentir de* (something), feel the effects of (something).

46.6.—*Chute*, noun, fem. sing. fall. A *parachute* is a machine to prevent a fall, as a *para-sol* is an invention for warding off the sun's heat.

46.7.—*toux*, noun, fem., sing.; cough.

46.8.—*fièvre*, noun, fem., sing.; fever.

46.9.—*ne tarda pas à se déclarer*, was not slow to declare itself.

46.11.—*désespérassent*, impf., subj., 3 pl. of *désespérer*, despair. Subj. by Rule F (5).

46.14.—*soit*, subj., pres., 3 sing. of *être*, to be. Subj. by Rule F (2).

46.16.—*se remit*, recovered; *remit*, pret., ind., 3 sing. of *remettre*, put back; recover.

46.21.—*moins encore*, still less.

46.22.—*n'ayant aucun moyen*, having no means. *Ne—aucun*= the adj. "no."

46.22.—*se procurer*, procure for herself. *Se* is ind. object.

46.23.—*voiture*, noun, fem., sing.; carriage.

46.24.—*d'attendre le traînage*, to wait for the sledging-season.

46.26.—*éprouver*, vb., inf.; experience.

46.27.—*suivit*, pret., ind., 3 sing. of *suivre*, follow.

46.28.—*les offices et la règle du convent*, the services and the rule (or *regulations*) of the convent.

46.31.—*études*, noun, fem., pl.; studies.

46.32.—*acheva de lui gagner*, succeeded in gaining for her.

46.33.—*prirent*, pret., ind., 3 pl. of *prendre*, take.

46.35.—*n'accomplît*, would accomplish. Do not translate *ne*. The subj. is by Rule F (2). When *douter* is used negatively, the subjunctive in the subordinate sentence also requires *ne*.

46.39.—*furent établis*, were in good condition.

46.40.—*couvert*, past part. of *couvrir*, cover.

46.41.—*faisaient*, impf., ind., 3 pl. of *faire*, make.

46.42.—*lui faire abandonner*, make her abandon. See note on 39.32.

47.1.—*pourrait*, condit., 3 sing. of *pouvoir*, be able.

47.3.—*reçue*, past part., fem., sing. of *recevoir*, receive. The participle agrees with *elle* by Rule C.

47.3.—*en fille chérie*, as a beloved daughter.

47.4.—*quel que fût*, whatever were. *Quel que* (not to be confounded with *quelque*, some)=whatever, and requires the subjunctive.

47.7.—*beaucoup d'égards*, much consideration.

47.8.—*retint*, pret., ind., 3 sing. of *retenir*, detain.

47.12.—*ses propres chevaux*, his own horses. See 45.13.

47.14.—*outre*, prep.; in addition to.

47.15.—*remises*, past part., fem., pl. of *remettre*, hand (when referring to *letters* &c.). The past part. agrees with *letters* by Rule C.

47.16.—*elle en reçut une*, she received one (lit. one *of them*, *i.e.* letters).

47.18.—*respectable*, adj., m. and f., sing.; esteemed, worthy.

47.21.—*vers*, prep., towards; *environ*, prep., about.

47.23.—*autant de*, as much.

47.24.—*qu'elle en avait*, as she had (lit. had *of it*, *i.e.* hope, &c.).

47.28.—*perdue*, past part., fem., sing. of *perdre*, lose.

47.29.—*avant de savoir*, before knowing.

47.30.—*remettre*, vb., inf.; hand in, deliver. See 47.15.

47.34.—*ne songeait guère à elle*, hardly thought of her. *Ne—guère*=hardly.

47.34.—*il s'était chargé*, he had undertaken.

47.36.—*demeure*, noun, fem., sing.; dwelling.

47.39.—*garde*, noun, fem., sing.; care.

47.40.—*sans—projets*, lit. without for that reason being to her of any help for her plans. Translate "without however helping her at all in her plans."

48.3.—*de l'autre côté*, on the other side.

48.4.—*bien détaillée*, fully given.

48.6.—*se mit en chemin*, lit. put herself on the road. Translate "set off."

48.8.—*la Neva était ébranlée*, lit. The Neva was in movement, *i.e.* the ice on the Neva had begun to break up.

48.9.—*débâcle*, noun, fem. sing.; melting.

48.11.—*revint*, pret., 3 sing. of *revenir*, return.

48.11.—*désolée*, part., fem., sing.; grieved.

48.12.—*Contre-temps*, noun, masc. pl.; mischance, mishap.

48.13.—*habitués*, noun, masc., pl.; frequent visitors.

48.14.—*très-mal à propos*, very improperly.

48.17.—*s'offrit*, lit. offered himself. Translate, "undertook."

48.18.—*écrivain*, noun, masc., sing.; writer.

48.18.—*rédiger*, vb., inf.; draw up.

48.21.—*conçus*, past part., fem.,, sing. of *concevoir*, draw up.

48.22.—*requise*, past part., fem., sing., of *requérir*, require.

48.23.—*moindre*, adj., superl. of *petit*, least. Petit has also a regular superlative, *le plus petit*.

48.24.—*dont*, in which.

48.25.—*remettre*, vb., inf.; hand in, deliver.

48.29.—*munie*, past part., fem., sing. of *munir*, provide.

48.30.—*solliciteuse*, noun, fem., sing.; petitioner.

48.31.—*le grand escalier*, the main staircase.

48.32.—*Chancelleries*, noun, fem., pl.; offices. The word is only applied to Government offices.

48.34.—*ne sachant à qui s'adresser*, not knowing to whom to apply; *sachant*, pres. part. of *savoir*, know.

48.35.—*dont elle s'approchait*, whom she approached.

48.37.—*jetaient*, imperf., ind., 3 pl. of *jeter*, cast.

48.37.—*coup d'œil*, noun, masc., sing., glance.

48.37.—*se remettaient à écrire*, commenced again to write.

48.40.—*écouter*, vb., inf.; listen to.

48.41.—*détournaient*, imperf., ind., 3 pl. of *détourner*, turn away.

48.22.—*ferait*, condit., 3 sing., of *faire*, do.

48.42.—*meuble*, noun, masc., sing.; piece of furniture.

48,43.—*barre*, pres., ind., 3 sing. of *barrer*; stop, *bar*.

49.2.—*tandis que*, whilst (expressing contrast).

49.3.—*en faisait autant*, lit. did as much of it. Translate, "did the same thing."

49.4.—*de manière que*, in such a manner that.

49.5.—*se heurtèrent*, pret., ind., 3 pl. of *se heurter*, come into collision.

49.10.—*croyant*, pres. part. of *croire*.

49.10.—*mendiante*, noun, fem., sing.; beggar, *mendicant*.

49.10.—*pour toute réponse*, lit. "for all answer." Translate, "by way of answering her."

49.11.—*prit*, pret., ind., 3 sing. of *prendre*, take.

49.17.—*voiture*, noun, fem., sing.; carriage.

49.18.—*étoiles*, noun, fem., pl.; stars.

49.19.—*poitrine*, noun, fem., sing.; breast.

49.19.—*elles*. The fem. pl. is used here, although men are referred to, because it replaces a feminine noun *(personnes)*.

49.20.—*bottes*, noun, fem., pl.; top-boots.

49.22.—*s'étaient*, they were.

49.23.—*attendant*, pres. part. of *attendre*, wait, expect.

49.24.—*d'après*, according to.

49.25.—*qu'elle s'en était formée*, lit. "that she had formed to herself of it." Do not translate *en*, (of it).

49.26.—*quelque chose de particulier*, something peculiar. An adjective joined to *quelque chose*, or *rien*, is connected with it by *de*.

49.27.—*n'offrit sa supplique à personne*, offered her petition to nobody. *Ne* must be used before the verb as *personne* (nobody) follows.

49.30.—*s'écoula*, pret., ind., 3 sing. of *s'écouler*; glide away, pass away.

49.34.—*elle fit part de son observation à la marchande*, she communicated her observation to the merchant's wife.

Faire part de (something), *à* (somebody), to communicate something to somebody.

49.35.—*à lui faire comprendre*, to make her understand. See note on 39.32.

49.38.—*vus*, past part., masc., pl. of *voir*, see. The past part. is masc. pl. by Rule D.

49.40.—*dû*, past part. of *devoir*, owe; *elle aurait dû remettre*, she ought to have handed in.

49.43.—*écrit*, noun, masc., sing.; writing, document.

49.43.—*arrivants*, noun, masc., pl.; arrivals.

49.44.—*pour ne pas manquer les sénateurs*, in order not to miss the senators.

49.44.—*sur la nature desquels*, lit. "on whose nature." Translate, "on whose identity."

50.1.—*il lui restait encore quelques doutes*, there remained to her yet some doubts.

50.3.—*voulut*, pret., ind., 3 sing. of *vouloir*, wish. For the *ne* see 49.27.

50.4. *gros*, adj., masc., sing.; stout.

50.5.—*cordon*, noun, masc., sing.; ribbon.

50.6.—*de chaque côté*, on each side. So in 49.3. *du même côté*, on each side.

50.7.—*se dit à elle-même*, lit. said to herself *(se)* to herself *(à elle-même)*. Translate, "said to herself."

50.9.—*il n'y en a point*, there are not any. *En*=any.

50.10.—*elle s'approcha de lui*, she approached him. *S'approcher de*=to approach.

50.12.—*vouloir bien*, be willing. *Vouloir*=to wish.

50.12.—*lui donner cours*, to forward it.

50.14.—*doucement*, adv., gently.

50.16.—*aumône*, noun, fem., sing.; alms.

50.16.—*Dieu vous bénisse*, i.e. *Je souhaite*, or *je désire, que Dieu vous bénisse*, I wish that God may bless you. Translate, "God bless you." *Benisse*, pres., subj., 3 sing. of *bénir*, bless.

50.18.—*plus de*, more than. *Plus de* = more than, when a number follows.

50.19.—*quinze jours*, a fortnight.

50.21.—*rester debout*, remain standing.

50.22.—*s'accroupissait*, imperf. ind., 3 sing. of *s'accroupir*, squat.

50.22.—*marches*, noun, fem., pl.; steps.

50.23—*réchauffer*, vb., inf.; warm.

50.27.—*trouvés*, past part., masc., pl. of *trouver*, find; past part. is masc. pl. by rule D.

50.31.—*se croisent*, lit. cross one another. Translate "*cross each other's path.*"

Croisent, pres., ind., 3 pl. of *croiser*, cross; not to be confounded with *croissent*, pres., ind., 3 pl. of *croître* grow.

50.33.—*sans se voir*, without seeing each other.

50.36.—*Compatissantes*, adj., fem., pl.; compassionate.

50.41.—*près d'elle*, near her.

50.42.—*sortit*, pret., ind., 3 sing. of the transitive verb *sortir*, take out.

50.44.—*Conçut*, pret., ind., 3 sing. of *concevoir*, conceive.

50.45.—*assignations*, noun, fem., pl.; banknotes.

50.46.—*parmi*, prep., amongst.

50.46.—*it en prit une*, lit. he took one of them (*en*). Do not translate *en*.

51.2.—*rendant*, pres. part of *rendre*, give back.

51.3.—*disparut*, pret., ind., 3 sing. of *disparaître*, disappear.

51.4.—*toute déconcertée*, quite disconcerted. The adverb *tout* becomes *toute* when preceding a feminine adjective or participle commencing with a consonant or aspirated *h*.

51.4.—*serra*, pret., ind., 3 sing. of *serrer*, roll up.

51.8.—*pris*, past part. of *prendre*, take.

51.10.—*Pâques*, noun, fem., pl.; Easter.

51.12.—*elle en profita*, lit. she profited by them; availed herself of them.

51.14.—*renouvela*, pret., ind., 3 sing. of *renouveler*, renew.

51.17.—*foi*, noun, fem., sing.; faith.

51.18.—*revint*, pret., ind., 3 sing. of *revenir*, return.

51.23.—*cette dernière*, this latter (i.e. *la marchande*).

51.24.—*partager*, vb., inf.; share.

51.25.—*voie*, noun, fem. sing.; way.

51.26.—*le jour de la rentrée du Sénat*, on the day of the re-assembling of the Senate. "On" with dates is not translated into French.

51.30.—*droschky*, a Russian four-wheeled carriage.

51.30—*sais*, pres., ind., 1 sing. of *savoir*, know. With *savoir, oser, pouvoir, cesser*, the *pas* of the negative is left out.

51.32—*démarches*, noun, fem., pl.; proceedings, steps.

51.33.—*je laisserais là*, lit. I would leave there. Translate, "I would leave alone."

51.35.—*feront*, fut., 3 pl. of *faire*, do.

51.35.—*tout comme*, just as.

51.40.—*que voilà*, lit. "which see there!" Translate, "which you see there."

51.40.—*obtiendrez*, fut., 2 pl. of *obtenir*, obtain; *vous n'en obtiendrez rien de plus*, you will obtain nothing more by it (*en* = by it).

51.45—*l'on*, one. *On* is preceded generally by *le* when it follows *et, que, ou, si*.

51.46.—*tout-puissant*, adj., masc., sing.; all-powerful.

52.2.—*peut*, pres., ind., 3 sing. of *pouvoir*, be able.

52.3.—*volonté*, noun, fem., sing.; will.

52.3.—*se baisser*, lit. lower himself. Translate, "stoop down."

52.5.—*fit un grand éclat de rire*, lit. made a great burst of laughter. Translate, "burst out laughing."

52.6.—*revenue*, past part., fem., sing. of *revenir*, return. Here translate, "recovered."

52.7.—*en rit*, laughed at it. *Rit*, pret. ind., 3 sing. of *rire*, laugh.

52.14.—*en revenaient*, returned from it. *Revenaient*, imperf., ind., 3 pl. of *revenir*, return.

52.18.—*puis*, pres., ind., 1 sing. of *pouvoir*, be able.

52.19.—*de bonne heure*, early. *De meilleure heure*, earlier, sooner.

52.20.—*y consentit*, consented to it.

52.21.—*fleuve*, noun, masc., sing.; river.

52.21.—*qui n'était—qu'une plaine*, which was—only a plain.

52.21.—*quinze jours auparavant*, a fortnight before.

52.53.—*glaçons*, noun, masc., pl.; blocks of ice.

52.23.—*mouvants*, pres. part., masc. pl., of *mouvoir*, move.

52.23.—*dégagé*, past part., masc., sing. of *dégager*, free.

52.25.—*embarcations*, noun, fem., pl.; boats.

52.25.—*espèce*, noun, fem., sing.; kind.

52.26.—*surprit*, pret., ind., 3 sing. *of surprendre*, surprise.

52.27.—*temps*, noun, masc., sing.; weather.

52.29.—*augurant bien*, lit., auguring well. Translate, "forming great hopes."

52.34.—*déjà*, adv., already.

52.34.—*prévenue*, past part., fem., sing. of *prévenir*, inform, forewarn.

(*Course of study for April.*)

1. Which adjective does not form its comparative and superlative by the addition of *plus* to the positive? Which adjectives have two forms for the comparative and superlative?

2. What are *conjunctive*, and what are *disjunctive* personal pronouns? Distinguish the possessive pronouns from the possessive adjectives.

3. What are the peculiarities of verbs ending in *evoir* (like *recevoir*). Notice particularly in what parts of the verb *ev* appears and when the cedilla is used.

Examination Paper.

1. Translate:—Mme. Milin *souriait* à ces reflexions de la jeune fille; mais elle pensait que rien ne devait être impossible à une piété si *vraie* à des prières n'ardentes. Celle pensée persuada, plus que toute autre chose, les deux charitables dames qu'il *fallait* la favoriser dans ses projets et l'abandonner à la Providence, qui semblait la protéger si visiblement. Mme. Milin et son amie n'avaient *rien* négligé, *jusqu'alors*, pour la dissuader, et lui avaient fait les offres les plus obligeantes pour la retenir auprés d'elles.

2. Parse the words underlined.

3. (*a*) Give the plural forms of *bateau, ville, palais, ciel, enfant*, and the feminines of *blanc, beau, méchant, cruel, complet, jaloux*.

(*b*) Give the plurals of *notre plume, ce bon cheval, mon nouveau livre*.

(*c*) Decline in full *elle, lequel*.

(*d*) Write out the 3rd pers. sing. and pl. of the past definite (preterite) of *être, aimer, concevoir, s'en aller*, and of the imperf. subj. of *avoir, fournir, répondre*.

(*e*) Write out some of the prepositions derived from participles.

4. Translate into French (*a*) Prascovie loved her parents; (*b*) The sun shines to-day; (*c*) It is you who have done this; (*d*) They lost their beloved daughter; (*e*) Have you ever seen these ladies before? (*f*) Who has done this? I, replied the child; (*g*) Has your brother come? (*h*) The letters you sent me were badly written; (*i*) It is necessary that you should go.

ANSWERS TO THE MARCH PAPER.

1. Often persons who had spurned her, seeing her go away weeping, called her back and treated her very well. Beggars accustomed to refusals appear little affected by them; but Prascovie, although placed by fate in a deplorable situation, had not yet been, before her journey, obliged to demand pity: and, notwithstanding

all her strength of mind and her resignation, she was heartbroken at refusals, especially when they proceeded from the bad opinion which people formed of her.

2. *rejetée*, past part., fem., sing. of *rejeter*, agreeing with its dir. obj. *la* (=Prascovie) in number and gender.
mendiants, noun, masc., pl., nom. to paraissent.
refus, noun, masc., pl., obj. case, governed by *à*.
y, pers. pro., pl. number, 3rd pers., objective case, depending on *sensibles*.
paraissent, pres., ind., 3 pl. of *paraître*, appear, agreeing with *mendiants*.
avant, prep. of time, governing *voyage*.
surtout, adv. of degree, modifying *navrée*.
provenaient, imperf., ind. 3 pl. of irreg. verb *provenir* (part. *provenant*, *provenu*) agreeing with *ils*.
l'on, indefinite pronoun, 3rd pers. sing., nom. to *prenait*.

3. (*a*)

Sing.	Plu.
Je m'étais éloigné(e)	Nous nous étions eloigné(e)s
Tu t'étais éloigné(e)	Vous vous étiez éloigné(e)s
Il s'était éloigné	Ils s'étaient éloignés
Elle s'était éloignée	Elles s'étaient éloignées

(*b*) *Prendre*, pres. part. *prenant*, past part. *pris*.
Faire, pres. part. *faisant*, past part. *fait*.
Voir, pres. part. *voyant*, past part. *vu*.
Mettre, pres. part. *mettant*, past part. *mis*.
(*c*) *Celui*, fem. *celle*.
Son, fem. *sa*.
Le sien, fem. *la sienne*.
Leur, fem. *leur*.

4. (*a*) Jean et moi, nous avions écrit nos thèmes.
(*b*) Quel livre avez-vous pris?
(*c*) Je n'ai que deux roubles en argent.
(*d*) Elle prononça ces mots d'un ton de voix si triste que sa mère en fut émue.
(*e*) Croyez-vous que quelqu'un puisse faire ce voyage en deux mois?
(*f*) Dites-lui d'aller vite chez le boucher.
(*g*) Les enfants commencaient à lire les livres que je leur avais donnés.
(*h*) Son père la prit par la main et lui adressa quelques paroles sérieuses.

N.B. Examination papers will be corrected *gratis* for students who are following the PRACTICAL TEACHER course in French. Send your worked papers to the office of this Journal, marked outside, "Scholarship French," and enclose a *stamped addressed* envelope for their return.

TEACHERS' DRAWING LESSONS.

SOLID GEOMETRY OR PROJECTION.

STANDARD VI.

BY E. BUFFERY RIDGE,
Art Master under the London School Board.

IV.—Blackboard, table, and a rectangular piece of stiff cardboard about 8″×5″. For scholar's use, front page of books, and a piece of cardboard 2″×1¼″.

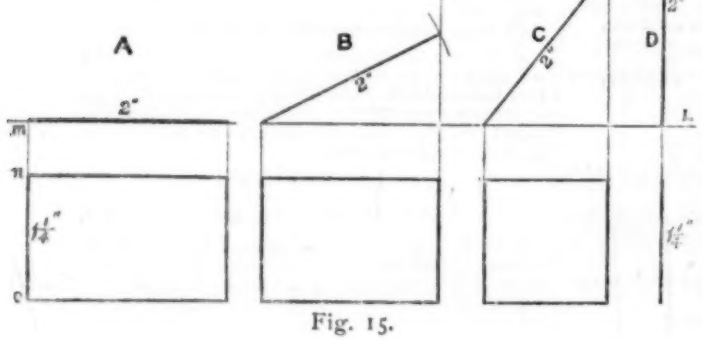


Fig. 15.

A rectangle is better to begin with than a square, because the different lengths of line are readily distinguished, while the equal lengths of the square are confusing.

The previous lessons on points and lines apply in every particular to the points or corners, and the lines or edges of the rectangle.

Place the rectangle flat on the table as at A. The long edges being parallel to the vertical plane will be seen in elevation in true length, while the short edges, at right angles to VP, will be points. All the lines are on the horizontal plane, therefore the elevation will form part of the ground-line. Viewed from the front the figure is a line; seen from above, it presents its *true shape* on the plane to which it is *parallel*.

Lift it up like the lid of a box on one end (B). The elevation is still of true length, because the long edges are still parallel to VP. But they are now *inclined* to the ground, and *shortened* in plan. The short edges are not altered in length, as they remain parallel to the ground, although one of them is lifted above it. The next position, C, shows a greater inclination and further shortening of the long edges. At D the rectangle is upright, and shows only a line in plan as well as in elevation. In all these positions the length in elevation and the width in plan remain unaltered. Draw the elevations, and from them obtain the plans, by dropping down perpendicular projectors, making *m n* any length in front (as no particular distance is specified), and in every case making *n o* 1¼″.

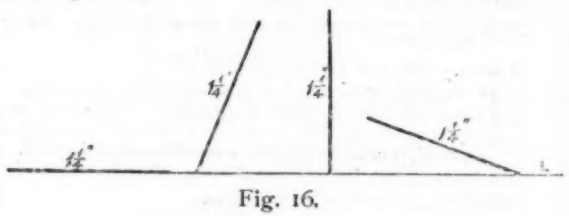


Fig. 16.

Elevations of the same figure;—draw the plans.

In Fig. 15 the *long* lines were *given in elevation* and the *short* lines *measured in plan*.

In Fig. 16 the short lines are given in elevation, and the long lines must be measured in plan. The distance *n o* in Fig. 15 will be 2″ in Fig. 16.

Place cards in every position, so as to *see* the plans before drawing them.

When a figure has two measurements, and one of them is given in plan or elevation, it is the other that is required to be measured in completing the drawing.

Plans of a rectangle 3″ × 1″. Obtain elevations. Draw up projectors, let the bottom of each elevation be in the ground line, and for the top, measure up the distance *not* seen in the plan—that is, if the plan is 3″ measure up 1″, if the plan is 1″ measure up 3″, first placing the cards in corresponding positions.

Problem 7.—A line 2″ long, inclined 30° to the ground-line, is the elevation of an oblong 2″ × 5″. Draw plan and elevation to half-scale.

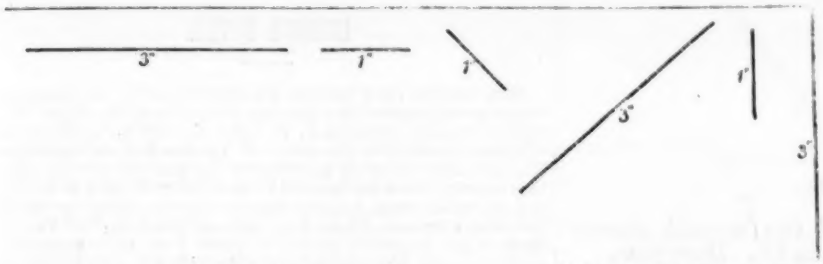


Fig. 17.

Problem 8.—The square is the plan of a rectangle $1\frac{1}{2}'' \times 2\frac{1}{2}''$. Draw its elevation.

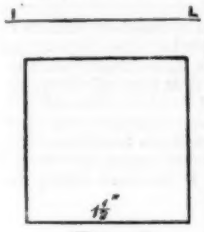


Fig. 18.

The measurement $2\frac{1}{2}''$, which is not used in plan, must be used in elevation.

Compare with C, Fig. 15. Finish as in Fig. 6.

Problem 9.—An oblong is shown in elevation. Its horizontal edges are half the length of the vertical edges. Draw its plan.

Drop perpendiculars, and complete as in Prob. 8, the distance *a b* being obtained by bisecting an upright line in the elevation.

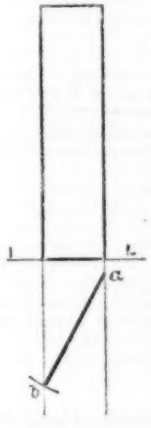


Fig. 19.

V.—Squares. For illustration use squares of cardboard or stiff paper, as in chap. IV.

A square has all its sides equal; it is as wide as it is long. Therefore when one side is shown in the diagram there is no necessity for the size of the square to be stated in the question. Fig. 20 shows elevations of squares of different sizes. Supposing each to be at right angles to the vertical plane and $\frac{1}{4}''$ from it, draw their plans. No difficulty will be found in working these if it is remembered that the lines to be measured in plan are equal to those shown in elevation. Measure *a' b'* and make *a c* equal.

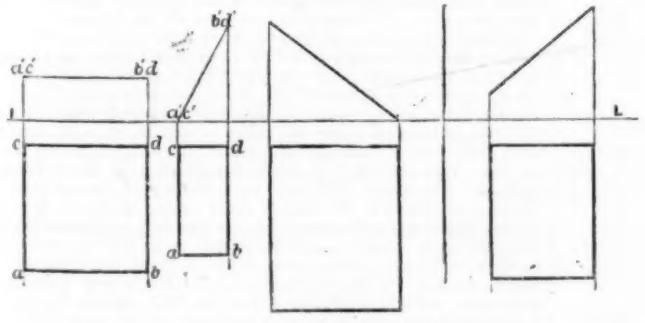


Fig. 20.

Notice that all these squares, like the rectangles in chap. IV., are at right angles to the vertical plane, so that, when viewed from the front, a line only is projected to form the elevation. The first square is parallel to the horizontal plane, on which its true shape is projected; the fourth is perpendicular to the ground as well as to the VP.

Upright squares and rectangles, with all other plane figures, show only a line in plan when seen from above. Fig. 21 gives the plans of squares and rectangles standing upright on the horizontal plane. To obtain the elevations draw projectors up from the plans and measure up from the ground line lengths equal to the plan in the case of squares, and the lengths mentioned in the questions and not shown in the plan in the case of rectangles.

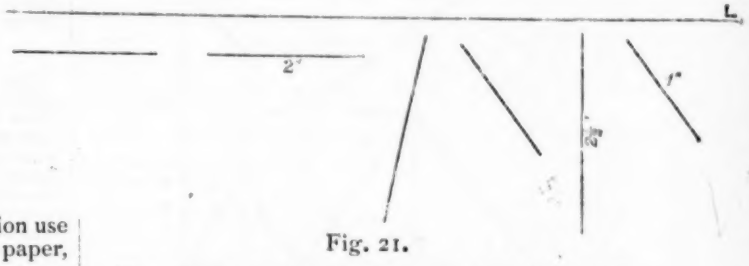


Fig. 21.

The diagonal of a square can be obtained by multiplying its side by 1·4141069+, but this is impracticable in geometrical drawing. Whenever either the side or the diagonal is given, and the other is wanted, it must be found by drawing the square and copying the required length.

Problem 10.—Plan of square. Draw elevation.

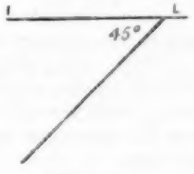


Fig. 22.

Problem 11.—Elevation of square. Draw plan.

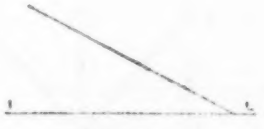


Fig. 23.

Problem 12.—Elevation of two unequal squares. Draw plan.

Work again Prob. 5, and compare with this.

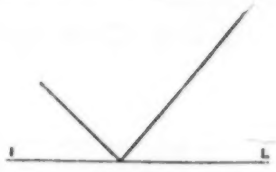


Fig. 24.

Problem 13.—Elevation of two unequal squares. Their diagonals are parallel to VP. Draw plan.

The plans of the diagonals shown will be parallel to IL. The other diagonals are parallel to the horizontal plane and at right angles to the vertical plane. They will be seen in true length in plan, and at right angles to IL. Bisect the two elevations, drop down perpendiculars, and measure on them lengths equal to half the elevation on each side of the plan in each case. Thus $c\,o$, $o\,d = d'\,c'$, $c'\,b'$. Compare with Problems 5 and 12.

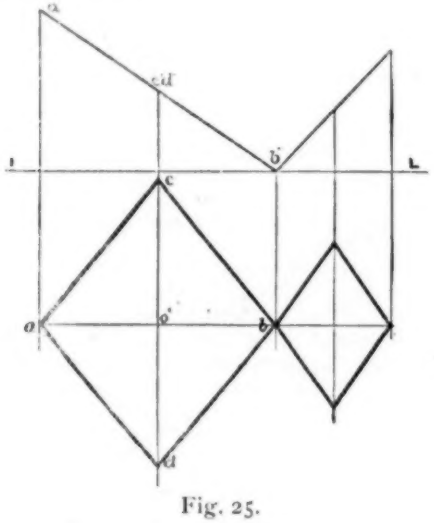


Fig. 25.

Problem 14.—*m n* is the plan of a square standing on one corner on HP. One diagonal is horizontal and the other vertical. Draw the elevation.

Draw projectors up from *m n* and from *o*, the centre. Mark *m o* up from IL twice on the centre line and once on each side line.

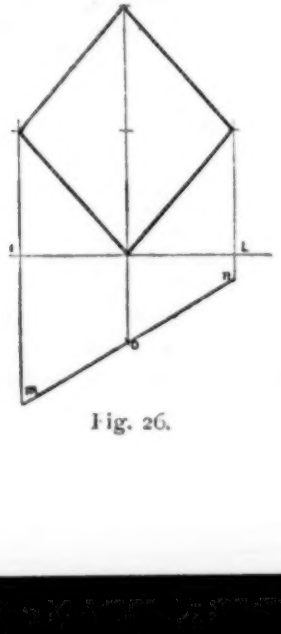


Fig. 26.

SCIENCE NOTES.

How Urban Fogs injure Vegetation.—In an interesting report recently made to the Scientific Committee of the Royal Horticultural Society, Professor F. W. Oliver presents the results of an extensive inquiry into the effects of London fogs on vegetation. The deleterious nature of these fogs is due partly to the impurities they contain, which are inimical to plant life, and partly to the loss of light, which results from the absorption undergone by the rays in traversing a stratum of dense fog. It is an interesting fact that no injury of any magnitude accrues to plants from mists uncontaminated by smoke, while urban fog contains sulphuric acid, sulphurous acid, hydrochloric acid, ammonia, metallic iron, ferric oxide, magnetic oxide of iron and hydrocarbons—a member of the pyridine series—and phenol, substances all of which have a toxic effect on vegetation. The action of these poisonous substances in the air is moreover considerably heightened by the darkness accompanying our yellow fogs. Both respiration and assimilation are seriously interfered with. While in dull weather the rate of starch-production in the chlorophyll-corpuscles is very small, during these fogs an infinitisimal quantity is found. Transpiration falls almost to a standstill; and the roots, nevertheless, continue their work of absorption, with the result that the cells of the plant become distended with water. Respiration becomes deficient, access of oxygen from without being a matter of increased difficulty—owing to faulty circulation in the intercellular passages, and one source of oxygen being almost entirely cut off, viz., the oxygen which is liberated during the process of carbon assimilation.

***

The Effect of London Fog on Foliage.—Ferns and the majority of Monocotyledons are found to suffer less from the deleterious effects of fogs than Dicotyledons, especially stove and greenhouse plants. Professor Oliver is of opinion that injuries to foliage from fog may be ranged under two classes—local discolorations, not speedily followed by the fall of the leaf; and whole or partial discoloration, on which disarticulation is rapidly attendant. The former he considers due to the mere corrosions of an acid deposit upon the epidermis—the unaffected parts of the leaf remaining fully functional. The fog deposits a layer of dirt on the surface, which contains an appreciable amount of sulphuric acid soluble in water. The upper epidermis is first attacked, the acid appearing to traverse the cuticle and to destroy the cells. The same action is continued in the subjacent tissues till the acid has worked its way right through the thickness of the leaf. Of quite a different character are the changes in the leaf which lead to its speedy disarticulation with or without the accompaniment of a change in colour. Here the fog actually effects an entry into the lacunæ, or system of intercellular spaces of the leaf, through the stomata, and the poisonous substances are brought into direct contact with the moist, delicate, and uncuticularised cell membranes of the living cells. As these membranes, composed of cellulose, can offer but little resistance, the protoplasm is directly attacked, and the capacity of resistance of the plant depends in the main upon the constitution of the protoplasm, though a thick external cuticle may arrest corrosion from an acid deposit, and few and small stomata may render the entry of noxious vapours less rapid than where they are larger or more numerous.

***

The Effect of London Fog on Flowers.—Flowers and flower buds are the first parts of the plant that suffer from the toxic effects of London fog, their surfaces being so little furnished with cuticle that poisonous constituents of the air easily penetrate the outer cell-walls. The poisonous vapours of the air, Professor Oliver considers, have a direct action on the living cells of the floral organs, resulting in their plasmolysis and the consequent collapse and translucency of the tissues. Flowers possessing a delicate pink or blue tint often lose this colour wholly or in part, apparently from the direct action of sulphurous acid. Many white flowers become slightly yellowed, droplets of yellow oil being formed in the cells, and a slight yellow colour developing itself in previously colourless corpuscles. This yellowing is ascribed tentatively to the action of pyridine. The slight blackening or browning of the apices and margins, noticeable in the case of many expanded flowers after a London fog, is due to the formation of a fine dark precipitate in the protoplasm, the nature of which remains to be fully ascertained. Many white flowers possess considerable power of resistance with regard to fog. White tulips, hyacinths, narcissuses, primulas, cyclamens, and chrysanthemums are but little injured by them. Injuries to flower buds occur most frequently at the stage immediately preceding the opening of the flower, when they seem exceedingly sensitive to toxic influences. Very young buds are not so

liable to injury as those further advanced, and lateral buds are more sensitive than terminal ones, the former sometimes dropping, while the latter remain and open later.

***

A NEW NITROGENOUS FOOD.—From Sweden comes the possible solution of a problem that has long vexed the agriculturist—What to do with superfluous skim milk? A process is now being worked in that country by which "lactoserin," a portable article of food rich in nitrogenous material, is obtained from the skim milk by the addition of rennet. After being pressed, the curds are dried in an oven, and are subsequently ground. It is to be hoped that the introduction of this new food will check the system, now prevalent among dairymen, of mixing separated milk with new milk.

***

THE ACTION OF SUNLIGHT ON BACILLI.—Sunlight would seem to be by far the most powerful agent in the purification of the air and rivers. In an interesting paper recently read before the Royal Society, Professor Marshall Ward has shown that the light of a winter sun and that of an electric arc rapidly destroy the life of the spores of the anthrax bacillus. The bactericidal action is really direct, and does not result from elevation of temperature, or from any indirect poisoning or starving process incident on changes in the food materials. The effect seems to be chiefly, if not entirely, due to the rays of higher refrangibility in the blue-violet of the spectrum. Professor Ward finds, too, that the inhibitory and deadly effects of direct insolation are not confined to *Bacillus anthracis*, but extend also to other bacteria and even to the fungi.

***

THE INFLUENCE OF EXTREME COLD ON CHEMICAL ACTION.—At a very low temperature Pictet finds that sulphuric acid and potash do not re-act chemically when in contact. This is the case generally when the reduction of temperature is sufficiently great, and the conclusion he arrives at after numerous experiments is that no chemical action takes place at a temperature between 155° below zero and 125° below zero. The more delicate re-actions, such as the coloration of litmus by acids, take place at lower temperatures than other kinds of energetic chemical action, such as that between sodium and sulphuric acid.

***

FRESH AIR.—It is possible to produce very pure air by artificial means. An apparatus has been devised for filtering and washing the air, the use of which might ensure the purification of the air supply in dwellings and public buildings. It consists of a screen, formed by stretching some thousands of cords of suitable material from the ceiling to the floor of the air chamber. The cords touch each other, and are interlaced with copper wires which are drawn tight to give the screen a flat surface. It thus presents the appearance of coarse cloth. As the air passes through, it is broken up into minute streams and is washed free from impurities by water trickling down the cords. Not a particle of the densest fog passes through the screen, and the filtered air is found to be bright and clear, perfectly sweet and free from odour.

***

THE SUMMER SCHOOL OF ART AND SCIENCE AT EDINBURGH.—The vacation studies of the Edinburgh Summer Extension Meeting are, this year, to be of a very practical character. In the daily course of lectures on Contemporary Social Evolution to be delivered by Professor Geddes, the students, beginning with a survey of the actual life around them, are to be taught to analyze these activities, and to consider their history and tendencies especially in relation to the practical economics of the day. Twenty lectures will be delivered on the history and principles of the sciencer—sociology, psychology, biology, geology, chemistry, astronomy, mathematics, and physics—and courses of practical work will be organised in biology, botany, zoology and geology. An interesting feature of the Summer School will be the regional survey of Edinburgh and its neighbourhood, including the shores of Fife; the comprehension of each of the urban or rustic industries dealt with being shown to involve not only the intelligent observation of its processes but also a scientific analysis of its social, biological, and physical conditions. It is hoped that the teacher will become interested in more and more fully applying this method in his own district, thus illustrating and enlivening his daily teaching and deepening his pupils' interest in the world around them. There is also to be a practical course of instruction in Sloyd given by Mr. Herzog of Nääs. As the accommodation for all classes is limited, intending students are requested to send in their names without delay to Mr. J. Arthur Thomson, University Hall, Edinburgh, stating as far as possible the lines of study they propose to select. J. R. G.

LEGAL AND CODE QUERIES COLUMN.

RULES.

1. All communications must be addressed "Legal Editor, PRACTICAL TEACHER, 5, Pilgrim Street, Ludgate Hill, E.C.," and must be accompanied by our "coupon," duly filled up.
2. Replies will be given *only* in this column, except under the conditions named in Rule 3.
3. If any reader desire a reply by post, such can be forwarded by enclosing, in addition to the coupon, a stamped addressed envelope and a shilling Postal Order.
4. No original documents should be forwarded, but copies only. We cannot hold ourselves responsible for any losses which occur through non-observance of this rule.

πR^2.—I have before me the official syllabus for the examination for Acting Teachers which will "commence on Monday, 11th December, 1893, at 3 p.m." (1) There appears to be no provision for giving extra marks for sciences obtained at the May examinations. (2) Yes, you can sit at either one or both of the examinations named.

MIHANGEL.—The Department will not, I believe, give any information as to the marks allotted to each particular subject.

WALES.—*Voters at School Board Elections.*—"In a parish which is not situate in the city of London, or in a borough other than the borough of Oxford, the book containing the last rate made for the parish more than one month previously to any date shall be the register of the ratepayers entitled to vote in such parish at that date; and every ratepayer whose name appears in such rate-book shall be entitled to vote unless he is disqualified from voting, and no person shall be entitled to vote whose name does not so appear" (36 & 37 Vict. c. 86. sch. 2 (*c*)). *School Reports.*—Yes, "Every ratepayer in a school district may, at reasonable times, without payment, inspect and take copies of and extracts from all books and documents belonging to or under the control of the School Board for the district. Any person who hinders a ratepayer from so inspecting or taking copies of or extracts from any books or documents, or demands a fee for allowing him to do so, shall be liable, on summary conviction, to a penalty not exceeding five pounds for each offence" (33 & 34 Vict. c. 75. sec. 87).

J. W. M.—No, you cannot hold the two offices at the same time.

TROUBLED.—Refer your solicitor to 6 T.L.R. 23 or 53 J.P. 743 D.

SCHOOL FEES.—If a child is sent to school without the school fees, the parent does not cause the child to attend school within the meaning of the bye-laws, although the child may be admitted to the school and receive instruction therein (London School Board *v.* Wood, L.R. 15 Q.B.D. 415 and 54 L.T., page 88).

W. S.—The contention is both unreasonable and illegal. If you are a member of the National Union of Teachers, place the matter in the hands of its Law Committee; if not, consult a good solicitor.

J. H. F.—It is dangerous to give opinions on excerpts from legal documents. If you will forward me a copy of the scheme, I shall be glad to advise.

Replies by post have been forwarded to W. F., ANXIOUS, DUBLIN, S. M., and PUPIL TEACHER.

J. C.—The decision you quote has been given since I last replied. It is authentic. The alteration will probably be noted in the New Code (1893-4).

NOTES AND NOTIONS.

BY RICHARD WADDINGTON,
Ex-President of the Half-Time Council.

THE Debate on Superannuation was a tribute to the power of the Union. Nothing could surpass the kindly feeling expressed by the House on Sir Richard Temple's resolution. Even Sir W. Harcourt's twenty-five millions failed to assuage the demand for the State-Aided Superannuation of the primary school teachers. It is to be hoped that Mr. Acland will remain at Whitehall long enough to place the good intentions of the Government on the Statute Book, and thus relieve the educators of this generation from continually feeling

> "Blow, wind! come, wrack!
> At least we'll die with harness on our back."

* * * * *

SOME months ago I gave some extracts from the Blue Book for 1850 bearing on the status and pay of the primary school teacher. When I read the report of the Debate on Superannuation my mind revered to 1850. For the sake of reference and comparison I cull a few extracts:—

1893.	1850.
"These men and women form one of the most useful, meritorious, and interesting classes in the community."	"A teacher who obtains their Lordships' lowest certificate of merit, and the grant of augmentation annexed to it, will be in the receipt of £45 per annum and a house rent free, or £55 per annum if he is not provided with a house rent free. My Lords are of opinion that such a minimum is not fixed at too low a point."
"They form a body of men and women second to none in the public service."	"The master has formerly been a sailor. His salary is only £7 a year and a house."
"I believe there are no public servants more deserving of consideration and encouragement than the teachers in elementary schools."	"The master, a superannuated labourer, a highly respectable man of the old parochial fashion."
"The teachers in our own schools are superior to those of the United States."	"The master is assisted by a very wee young person, the wife of the rector's gardener."
"We have very handsomely pensioned constables and civil servants, and we ought to give a pension also to these hard-working servants of the public, the teachers of our children."	A certificated master, besides a house, receives (in salary and Government grant together) about £90 per annum, and a certificated mistress £60. This is liberal payment for young men and women, the children frequently of artizans and labourers, in a comfortable and honourable position." (Newcastle Commission, 1862.)

* * * * *

AND now I want to ask all the thirty thousand teachers who will equally share the fruition of the labours of their fellows who have made State-Aided Superannuation a part of the practical politics of the day. What are you doing? The details of superannuation will be moulded for the teachers' good just in proportion to the strength and activity of the Teachers' Union. To each one of this thirty thousand I would say, "Be not content to stand idly and selfishly by until the contest is o'er." It is every teacher's duty to be enrolled within the ranks of the N. U. T. without delay. With twenty-three thousand members the House of Commons has been converted to some scheme of superannuation. With fifty thousand members we should assuredly get a *good* scheme. Let us hope the cry from Liverpool to Oxford will be:—

> "Hang out our banners on the outward wall,
> The cry is still, 'they come.'"

* * * * *

ERE this meets the eye of the reader, his mind will be fixed on Liverpool. From all I hear, the Conference of 1893 is likely to be as successful as any of its predecessors. The Liverpool contribution to the charities is likely to be a large one. A large commercial and educational centre, with a powerful press, Liverpool will form in many respects an ideal conference town. Since the Birmingham Conference, the dinner has formed an important function at every conference, but at Liverpool there is to be no dinner—I ought to say public dinner—and no public meeting. For one evening representatives will be free to "sniff the briny," unless some restless spirits organise a meeting of "indefatigables." Nothing would accelerate the growth of unionism more than a repetition of the Cheltenham "Symposium," whereat the workers of the local organisation might freely interchange methods of organisation and discuss the plan of campaign for the future.

* * * * *

The charities might gain by a symposium of enthusiasts in the cause of the widow and the orphan. Liverpool is a good town for "raising the wind." What says Mrs. Burgwin and Mr. Devonshire?

* * * * *

THE Agenda for the Liverpool Conference is not less bulky than usual. The programme ought to be full and satisfying, and it will require all the tact and good generalship Mr, Bowden can command to clear the arranged agenda by Thursday afternoon. The Conference opens at 2 p.m. on Monday, April 3rd, with a public reception of the Conference by the local authorities, whereat we may anticipate to hear the praises of "Dicky Sam." Mr. Bowden's presidential address follows, and in the evening the Annual Meeting of the charities will be held.

Tuesday opens with the declaration of the Executive poll; and after a resolution on the areas of School Boards, Mr. Ellery reads a paper on Superannuation. At noon, deputations from Ireland, Scotland, and Belgium are to be received. The afternoon is to be a private session, and the main bone of contention will be the report on Electoral Districts.

Wednesday morning will be specially a busy one. At 9.30, Mr. Yoxall reads a paper on the "Salaries of Assistant Teachers," and later on in session I am to read a paper on "Child Labour," whereon Bradford and Leicester promise to raise a lively debate on the "Age and Attendance" programme of the Union.

* * * * *

WEDNESDAY afternoon is to be devoted to the "Reception of Purses and awards of Trophies."—May they be well lined and very plentiful.

Thursday morning is to be devoted to the consideration of the Code, when I anticipate it will hardly be evident

"The thought of our past years in me doth breed
Perpetual benediction."

* * * * *

About the agenda for Thursday afternoon there is an air of Secondary Education. While Friday and Saturday will find many pedagogues disporting themselves on the river, or on a visit to "Ham and Egg Terrace" at New Brighton, or perchance sailing down our splendid Ship Canal to Saltport. And to the representatives to the Liverpool Conference we cannot give better advice than—

"Let your speech be always with grace, seasoned with salt."

* * * * *

In replying to a vote of thanks for his efforts for the Union in his capacity as editor of the *Schoolmaster*, Mr. Macnamara told a good story, which, as he told it, went against himself. This was the story:—"During a visit to a Provincial Association, he was entertained at a complimentary dinner. In proposing the 'Organ of the Union,' a gentleman said: An old college friend of his, a Scotchman, would never read the *Schoolmaster*. When some time ago he wrote again to him, and asked him if he read the paper, the reply came: 'Opposite my: "diggings" there is a graveyard. When I want to be melancholy, I generally visit it. This is cheaper than buying a penny paper that issues a double number every week.'"

* * * * *

Well, I was there and enjoyed the story, but it was told to show the improvement the new editor had made, for this reply came under the old *régime*, and it was followed by the announcement that under the altered conditions the Scotchman had given up the graveyard and taken to the paper.

* * * * *

The Secondary Education Bill brought in by Sir Hy. Roscoe, Mr. Hy. Hobhouse, and Sir John Lubbock, contains some 31 clauses. The most serious blot on the Bill is the creation of new educational authorities to deal with Secondary Education. This is a serious matter, and if there is to be that "ladder from the gutter to the University" there must be only one educational body to deal with primary and secondary schools, and finally, the Universities. The creation of the new educational authority suggested in the Bill will be a serious obstacle to the correlation of all grades of education—which is the desire of every true educationist. Under the Bill the higher grade schools, many of whom are genuine secondary schools, and the local grammar schools, will be under the management of separate authorities. Whatever step is taken, must be taken in the direction of creating one educational body for all phases of education.

* * * * *

Some of the answers given on the examination day are really funny. A child had been taught that "Epiphany" meant "the manifestation," and at the examination startled the solemn and sedate inspector by replying, "The man at the station."

* * * * *

An inspector was talking to a class of young children on feathered birds in a Lancashire school. In reply to his request for the names of some, came "dandy-cock," "dandy hen," and then there was one of those periods of deadly silence which announce the end. But the inspector was not to be satisfied, like Oliver Twist, he asked for more, and one little girl came to the rescue with "Dandelion."

* * * * *

Mr. Tom Mann has issued his programme as labour candidate for the parliamentary representation of the Colne Valley division of Yorkshire. Among other things he advocates:—

1. The maximum age for children as half-timers to be raised as early as possible to 13.
2. Attendance at continuation and technical schools to be compulsory till the age of 16.
3. Perfectly free elementary, secondary, and technical schools, with greater regard to physical education, and with popular control.

Not a bad programme, especially considering that Mr. Mann is supported by the textile workers of this division of Yorkshire. I would commend this programme, and the resolution of the Newcastle Trades Union Congress, suggesting that no child should work under 13, to the consideration of Mr. Acland before his School Exemption Bill reaches the committee stage, and I hope the result will be the acceptance of 12, in lieu of 11, at least.

* * * * *

I have before called attention to the Science and Art Department's idea of freedom of classification in Drawing. The three following cases have come under my notice:—

1st. The Department refused to pay the grant for Ex. St. VII. scholars who passed in Second Grade subjects, on the ground that they were not *ex. St. VII. in drawing*.

2nd. A teacher in a small country school, who took drawing for the first time last year, and whose highest standard in drawing was the third, finds this year that his last year's third standard has disappeared, and he has no scholars to present in the fourth standard. The inspector demanded that the teacher must promote at least one of last year's second standard to the fourth.

3rd. A boy in the fifth standard for drawing is Ex. VII. in other subjects. The Department require that boy to be presented in Second Grade.

Where are we now? Does the Department understand its own rulings?

PUPIL TEACHERS' COURSE.

TEST EXAMINATION QUESTIONS.

First Year—Boy and Girls.

(Answer Questions 1 and 6 and any two other Questions.)

1. Analyse the subjoined passage and parse the words in italics:—

Him rising from *her earnest* prayer
Fair *Adeline found standing* there
With lips of woe and *brow* of care.

2. Give a list of nouns whose meaning in the singular differs from that of the plural. (25)

3. Write down the present tense, past tense, and past participle of grew, brew, sew, drew, crew, hew, mew, flew, knew, strew, view, blew, stew. (25)

4. What prepositions should follow depend, accordance, according, different, concur, prejudiced, pleased, desirous? (25)

5. Draw up a table of adverbs. (25)

6. Reproduce in your own words the story read by the Examiner. (40)

Second Year—Boys and Girls.

(Answer Questions 1 and 6 and any two other Questions.)

1. Analyse the following lines and parse the italicised words :—

From *my* wings *are shaken*
The dews *that* waken
The sweet *buds* every *one*
When *rocked* to rest
On *their* mother's *breast*
As she *dances about* the sun. (35)

2. Paraphrase the above passage. N.B. wings = fringes of cloud. (25)

3. Say how you would explain the meaning of the grammatical term *voice* to a class of children, and what illustrative sentences would you give? (25)

4. Explain the construction and uses of prepositional phrases. (25)

5. Construct words (and explain their meaning) so that each shall contain one of the following prefixes and one of the affixes :—*Ab, tion, Con, ble, Ante, ate, Sub, ive, In, ose, De, fy.* (25)

6. Write a short essay upon "The naval supremacy of England" *or* "Strikes" *or* "Waste not, want not." (40)

Third Year—Boys and Girls.

(Answer Questions 1 and 2 and any other two Questions.)

1. Paraphrase this passage :—

Romeo. *Lady* by *yonder* blessed moon I swear
That tips with silver *all* the fruit-tree tops
Juliet. Oh, *swear* not by the moon, the inconstant *moon*
That *monthly* changes in her *circled* orb,
Lest they *that* love *prove* likewise *variable.* (40)

2. Analyse the above passage and parse the words in italics. (35)

3. What do you know of the origin, formation and precise meaning of the following words. Place each of them in a separate sentence of your own making :—Connective, difference, epitaph, photograph, effervesce, intimidate, inhabit, innumerable. (25)

4. If any of the following sentences are faulty correct them :—

I didn't see him nor hear him.
He was opposed against him.
They were wiser than us.
I speak of Milton, a poet than whom none was more learned.
The lake was very frozen yesterday.
We all of us combined together. (25)

5. Give examples of a noun sentence in apposition, as subject, as object, and governed by a preposition. (25)

PENMANSHIP.

ALL YEARS.

Full Marks—40.

Large Hand.—Hieroglyphics. (20)
Small Hand.—Quebec is the Gibraltar of America. (20)

DOMESTIC ECONOMY.

SCHOLARSHIP.

Only three questions to be attempted.

1. What are the special advantages of woollen material for clothing? Is any especial care required in washing woollen articles? (20)

2. In what way have you been taught to relieve any of the school children suffering from the following causes :—A burn, a bruise, a severe cut, an attack of fainting, bleeding at the nose, chilblains? (20)

3. State briefly the cost, the time required, and the method of cooking *two* of the following :—A mackerel, a poached egg, a potato pie, a rice pudding.

4. Describe in a letter to a Pupil-Teacher the advantages of the system carried out in the Post Office Savings Bank. (20)

5. Describe the method of scouring a room. (20)

ARITHMETIC.

FIRST YEAR.—BOYS.

Answer three questions only, including question 2.

1. How many tons of gold at £3·89375 per oz. are contained in a lump worth £113·6975? Ans. ·0008147.....tons. (25)

2. What is a Measure—a Common Measure—and the Greatest Common Measure? Find the G. C. M. of £2 6s. 3d. and £3 16s. 3d. Ans. 1s. 3d. (30)

3. Simplify $\frac{1\frac{3}{8}-\frac{1}{8}}{1\frac{3}{8}+\frac{1}{8}}+\frac{1\frac{3}{8}+\frac{1}{8}}{1\frac{3}{8}-\frac{1}{8}}$ and add together $\dot{7}+\dot{0}\dot{7}+\dot{0}0\dot{7}+0\dot{7}0\dot{7}$.

Ans. $2\frac{4}{99}$; ·9263. (25)

4. Write down all the numbers of 4 digits you can form with the digits 3, 6, 0, 4 and add them together. Ans. 83772. (20)

GIRLS.

1. How many tons, cwts., etc., are there in as many ounces as there are seconds in a week? Ans. 16 tons, 17 cwts., 2 qrs. (30)

2. As for Boys. (30)

3. Make out and duly receipt a bill for:—

		s.	d.
12¼ lbs. of beef at ½d. per oz. - -	Ans.	8	2
14⅜ lbs. of mutton at 7d. per lb. -	,,	8	5
12⅜ lbs. of veal at £1 3s. 4d. per qr.	,,	10	6
18 lbs. of bacon at 3 lbs. for 1s. 10d.	,,	11	0
A ham, 15s. 0d. - - - -	,,	15	0
	£2	13	1

(20)

4. As for Boys. (20)

SECOND YEAR.

Do three questions only, including the last, if you can.

BOYS ONLY.

1. Find the amount of £50 4s. 2d. for 2 years at 4 per cent. Comp. interest. (25) Ans. £54.6s. 1·3d.

2. A tradesman's prices are 20 per cent. above cost price. If he allows a customer 10 per cent. on his bill, what profit does he make? Ans. 8 per cent. (20)

3. By selling out £4,500 in 5 per cents. at 112½, and investing in the seven per cents., I increase my income by £168 15s. What is the price of the latter stock? Ans. £90. (25)

4. Explain the terms *ratio, premium, par, average,* giving examples.

If I earn in 5 days an average wage of 15s·6̇, during the first three of which my average wage is 16s. ·3̇, what will be my wage for the fifth day, if I earn thereon twice as much as on the fourth?

Ans. 19s. ·5̇. (30)

GIRLS ONLY.

1. Divide £29 into an equal number of half-sovereigns, crowns, half-crowns, shillings, sixpences, and fourpences.

Ans. 30 of each. (25)

2. Sum 2 of first year boys. (20)

3. Reduce $\left\{\frac{1\frac{3}{8}-\frac{1}{8}}{1\frac{3}{8}+\frac{1}{8}}+\frac{1\frac{3}{8}+\frac{1}{8}}{1\frac{3}{8}-\frac{1}{8}}\right\}$ of 1 cwt., 3 qrs., 6 lb., to the vulgar fraction of $4\frac{5}{99}$ lbs.

Ans. $\frac{1}{3}$. (25)

4. Illustrate by a diagram $\frac{1}{3}+\frac{1}{6}=\frac{1}{2}$. Reduce $\frac{3}{7}$ to fractions, having first a numerator 2, and second a denominator 5.

Ans. $\frac{2}{4\frac{2}{3}}$, $\frac{2\frac{1}{7}}{5}$. (30)

THIRD YEAR.

Answer three questions, incuding the last if you can.

BOYS ONLY.

1. Extract the square root of 30 to 4 places of decimals.

Ans. 5·4772. (15)

2. Find the discount on £78 9s. 9d. due 8 months hence at 6 per cent. Ans. £7 10s. $10\frac{11}{18}$d. (25)

3. Divide $\frac{1\cdot\dot{0}\ddot{6}}{1\cdot\ddot{4}\dot{2}} \times \frac{3\cdot\ddot{3}\dot{2}}{2\cdot\ddot{4}\dot{7}}$ by such a number as will give ·9̇ as quotient. Ans. 1. (25)

4. (*a*) Prove that a fraction is multiplied by a whole number when its denominator is divided by that number.

(*b*) A man walks a certain distance, and rides back in 5½ hours. He could walk both ways in 7 hours. How long would it take him to ride both ways? Ans. 3½ hours. (35)

GIRLS ONLY.

1. Sum 3 of Boys. (25)

2. A bankrupt can pay 5s. 9d. in the £. If his assets were £500 more he could pay 6s. 6d. Find his debts and assets.
Ans. £13,333 6s. 8d.; £3,833 6s. 8d. (25)

3. An English mile is ·2136 of a German mile. What time will a man who walks a German mile in two hours take to walk an English mile? Ans. 25 minutes $37\frac{3}{4}\frac{3}{9}$ seconds. (20)

4. A draper sold $\frac{4}{11}$ of a roll of ribbon to Ettie, and $\frac{3}{7}$ of the remainder to May, and the latter had 2½ feet less than the former. What was the length of the remainder?
Ans. 12 yards 2 feet 6 inches. (35)

TEACHING.

BOYS AND GIRLS.

Answer two questions only.

1. Give as many forms of mental exercise as you can upon the number 36. (20)

2. What are the chief faults to be found in writing the words "Sacks of sovereigns"? (20)

3. What special features should a good Reading Book contain, and why? (20)

THIRD YEAR.

1. Work out notes of a lesson on "*The Thames*" or on "*A Triangle.*" (20)

2. What different methods are employed in working the sum 403 *minus* 317? Which do you prefer? Give reasons. (20.)

3. What place should Dates hold in the Teaching of History? Give reasons, *or* draw up a list of the first twenty object lessons you would give to "*five-year-olds.*" (20)

ALGEBRA.

THIRD YEAR, BOYS.

Answer three questions, including Question 4 if you can.

1. The product of two algebraic expressions is $14a^4-45a^3b+78a^2b^2-45ab^3+14b^4$ and one factor is $7a^2-5ab+2b^2$. What is the other? Ans. $2a^2-5ab+7b^2$ (15).

2. Find the G. C. M. and L. C. M. of $4x^3+4x^2y-9xy^2-9y^3$ and $6x^3+x^2y-16y^2-6y^3$.

Ans. $(x+y)(2x-3y)$; $(x+y)(2x-3y)(2x+3y)(3x+2y)$. (15).

3. (*a*) Simplify $\left(\frac{a}{b}+\frac{b}{a}+\frac{b}{c}+\frac{c}{b}+\frac{a}{c}+\frac{c}{a}+2\right) \div (a+b)(b+c)(c+a)$. Ans. $\frac{1}{abc}$.

(*b*) $\frac{2}{x-1}+\frac{2}{x+1}+\frac{4x}{x^2-x+1}$. Ans. $\frac{4(2x-x^2)}{(x-1)(x^3+1)}$.

4. (*a*) Show that the square of the sum of any number and its reciprocal, together with the square of the difference of the number and its reciprocal, is double the sum of the squares of the number and of its reciprocal.

(*b*) Solve $\frac{6x+7}{9x+1}-\frac{4x+3}{9x+1}=0$. Ans. $x=-\frac{4}{17}$

MENSURATION.

THIRD YEAR, BOYS.

Answer One Question only.

1. A ladder 25 feet long stands upright against a wall; find how far the bottom of the ladder must be pulled out from the wall so as to lower the top one foot. Ans. 7 feet. (20)

2. The parallel sides of a trapezoid are respectively 16 ft. and 20 ft, and the perpendicular distance between them is 5 ft. The two other sides are produced to meet; find the perpendicular distance of the point of intersection from the longer of the two parallel sides. Ans. 25 feet.

EUCLID.

Answer two questions, including Question 3 if you can.

SECOND YEAR, BOYS.

1. If one side of a trangle be produced, the exterior angle is greater than either of the interior opposite angles. (20)

2 If two triangles have two sides of the one equal to two sides of the other each to each, but the angle contained by the two sides of the one less than the angle contained by the two sides equal to them of the other, the base of that which has the less angle is less than the base of the other. (20)

3. Draw a straight line through a given point, to make equal angles with two given straight lines which meet. (30)

THIRD YEAR, BOYS.

1. If one side of a triangle be produced, the exterior angle is equal to the two interior and opposite angles. (20)

2. In any right-angled triangle the square of the hypotenuse is equal to the sum of the squares on the two sides. (20)

3. If two right-angled triangles have the hypotenuse and one side equal, they are equal in all respects. (30)

GEOGRAPHY.

BOYS AND GIRLS.

Answer three questions only, and include Question 5.

FIRST YEAR.

1. Describe the courses of any three rivers on the eastern side of Great Britain, naming the towns on their banks. (25)

2. Where and for what noted are—Rockhampton, Greenock, Killarney, Three Rivers, Boston. (25)

3. Account for the climate and describe the productions of Van Dieman's Land and Labrador. (25)

4. Enumerate the various volcanic belts. (25)

5. Draw a map of the Six Northern Counties or of the Caledonian Canal. (30)

SECOND YEAR.

1. What portions of Europe are inhabited by Teutonic, Celt, and Sclavonian races respectively, and what is the prevalent religion of each race? (25)

2. Describe a land journey from St. Petersburg to Madrid, *or* a voyage from Gibraltar to Bombay. (25)

3. What is the position and importance of each of the following:—Brindisi, Pondicherry, Heligoland, Bucharest, The Sound, Kandy, Cronstadt, Simla, Ajaccio? (25)

4. Explain the relation between longitude and time. When it is noon at Greenwich, what is the time at a place situated 5½ degrees W. Long., and at a place 5½ degrees E. Long. (25)

5. Draw a map of the North Mediterranean Coast from Barcelona to Venice; *or* of the coast from Calais to Barcelona. (30)

THIRD YEAR.

1. Where and what are the following:—Port Said, Sofala, Rangoon, Mecca, Kenia, Nagasaki, Mekong, Peshawar? (25)

2. Compare the flora and fauna of Asia and Africa. (25)

3. Describe a coasting voyage from Canton to Calcutta, *or* a land journey from Zanzibar to Ujiji. (25)

4. What is meant by land and sea breezes? Describe the course of the Japan current.

5. Draw a map of Cape Colony, *or* of the eastern portion of the Mediterranean. (30)

HISTORY.

BOYS AND GIRLS.

Answer three questions only.

FIRST YEAR.

1. What Roman and British relics are still extant in England? (25)

2. Of what importance were Chester, Winchester, Colchester, Dorchester, and Lincoln during the Roman occupation? (25)

3. Who and for what noted were Caradoc, S. Alban, Carausius, Lady of Mercia, Caedmon, Dunstan, Morcar, and Hereward? (30)

4. Compare the characters of the Saxons and Normans. (25)

5. For what were the following years noted :—62, 410, 449, 597, 835, and 1066? (25)

SECOND YEAR.

1. What do you know of any of the following :—Strongbow, Odo, Peter the Hermit, and John of Gaunt? (25)

2. Who were the Lollards, the Lords Ordainers, Tenants in capite, and Justices in Eyre?

3. Give dates of Battle of the Standard, Assize of Clarendon, Magna Charta, Mad Parliament, and first Statute of Labourers. (25)

4. What English Sovereigns from 1066 to 1485 died natural deaths? Who succeeded them? (25)

5. Enumerate the chief provisions of Magna Charta *or* of the Constitutions of Clarendon. (25)

THIRD YEAR.

1. Trace the growth of the English navy up to 1688. (25)

2. What was the foreign policy of Henry VIII., and how was it influenced by Wolsey? (25)

3. What causes combined to render the Tudor sovereigns almost absolute? (25)

4. For what are the following years celebrated :—1535, 1587, 1605, 1628, 1668, and 1688? (25)

5. What were the claims to the throne of Henry VII., James I., and Charles II? Trace the descent of James I from Edward III. (30)

NEEDLEWORK.

Answer one question only.

FIRST YEAR.

1. Cut out and tack together a paper pattern of a nightshirt (full size) for a child six years of age, and mend a hole in stocking material. (60)

2. Make a wristband for a boy's shirt; stitch three inches of it and sew on a button. (60)

SECOND YEAR.

1. Make up in print a short sleeve of a child's nightgown and herring-bone a patch three inches square on coarse flannel. (60)

2. Draw the flat pattern of a woman's nightgown (¼ size) upon sectional paper and make a button-hole in calico. (60)

THIRD YEAR.

1. Cut out in paper and tack together a child's frock bodice; and on coarse linen work a hedge-tear darn. (60)

2. Make and put in a gusset as for the side opening of a child's pair of drawers. Show how you would strengthen this side opening.

RECENT EXAMINATION IN DRAWING.

SCHOOL OF 180 BOYS IN CAMBRIDGESHIRE.

THE Inspector arrived at 9.40, and immediately set down the P.Ts. to their examination. He objected to the use of examination papers on which the centre was indicated by a small dot printed on *both* outer edges, and said that the heading should allow for the *full* name of the school to be inserted. In Standards I. and II. the teacher was informed that if the construction was drawn *faintly* it need not be deleted. He recommended the use of straw boards throughout the school.

STANDARD V.—The boys were divided into three sections :—

Freehand.—A glue pot—rather a stiff copy—from a sheet pinned to the B. Board.

Model.—A cube placed in the second position shown in the Illustrated Syllabus.

Geometry.—(1) Describe a circle of 1 inch radius, and divide it into four equal parts. (2) Copy the line AB, and on AB construct an equilateral triangle. (3) Copy the given angle and divide it into two equal parts.

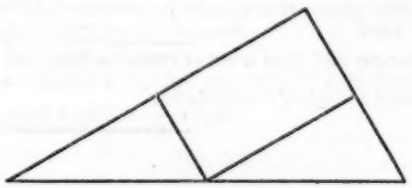
STANDARD IV., divided into three sections :—

Freehand.—A *fleur de lis* from a sheet pinned to the B. Board. Fairly easy.

Geometry (Plane Paper).—(1) Draw this envelope three times the size. (2) Draw this Oxford frame, using a scale of 1 inch to the foot. (Squared Paper.)—(1) A dog kennel. Each square to represent 1 in. (2) A gate. Each square to represent 3 inches.

STANDARD III.—*Freehand*—The outline of a plum, from a copy pinned to the B. Board. A difficult copy.

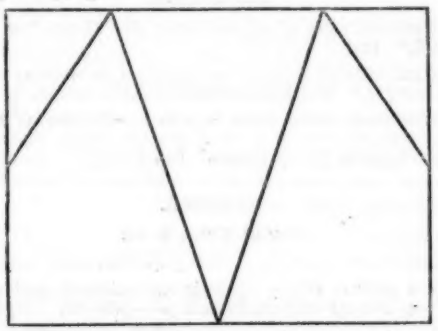
Freehand and Ruler.—The figure was drawn from a sheet pinned to the B. Board, and consisted of a right-angled triangle, having the sides enclosing the right angle bisected and joined to the bisection of the hypotenuse.



It was to be drawn first Freehand and then with Ruler.

Ruler alone.—This section drew from cards. The test consisted of a Greek Fret and a Hexagon, to be copied a little larger.

STANDARDS II. and I.—Each division received a lesson, the same example being used for both. The construction consisted of an oblong four inches by three; each side was bisected, and each portion of the upper four-inch side was again bisected. The example consisted of lines drawn from the outermost divisions of the upper line to the points of bisection of the opposite sides, forming an irregular zig-zag.



The examination was conducted very pleasantly, and ample time was allowed.

REVIEWS.

Physiography. Advanced Course. By the late Andrew Findlater. Revised edition by David Forsyth. London and Edinburgh: W. and R. Chambers, Limited.

In many respects this little book is excellent. It is admirably printed, and the illustrations are neat, and, for the most part well chosen. The book has been arranged to suit the requirements of students preparing for the advanced stage of the examination in physiography of the Science and Art Department. Unfortunately it does not go far enough, and especially is this the case in spectroscopic matters. For this reason, the student who uses the book for the South Kensington examination will have to supplement his reading if he desires to pass.

A couple of errors have been noticed, which it would be well to alter in future editions. Dr. Forsyth says: "Hydrogen and nitrogen gases seem to be the main constituents of these nebulæ." No one now believes that nitrogen manifests itself in nebulæ. Dr. Huggins once supposed the brightest line in the spectrum of nebulæ to be due to nitrogen, but he has abandoned the opinion, and even Prof. Young, who Dr.

NOTES AND NOTIONS.

BY RICHARD WADDINGTON.

Ex-President of the Half-Time Council.

THE Debate on Superannuation was a tribute to the power of the Union. Nothing could surpass

thousand members we should assuredly get a *good* scheme. Let us hope the cry from Liverpool to Oxford will be:—

"Hang out our banners on the outward wall,
The cry is still, 'they come.'"

* * * * *

ERE this meets the eye of the reader, his mind will be fixed on Liverpool. From all I hear, the

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"Let your speech be always with grace, seasoned with salt."

* * * *

the Colne Valley division of [illegible] other things he advocates:—

1. The maximum age for children as half-timers to be raised as early as possible to 13.
2. Attendance at continuation and technical schools to be compulsory till the age of 16.
3. Perfectly free elementary, secondary, and technical schools, with greater regard to

4. What prepositions should follow depend, accordance, according, different, concur, prejudiced, pleased, desirous? (25)

5. Draw up a table of adverbs. (25)

6. Reproduce in your own words the story read by the Examiner. (40)

Second Year—Boys and Girls.

(Answer Questions 1 and 6 and any two other Questions.)

1. Analyse the following lines and parse the italicised words :—

From *my* wings *are shaken*
The dews *that* waken
The sweet *buds* every *one*
When *rocked* to rest
On *their* mother's *breast*
As she *dances about* the sun. (35)

2. Paraphrase the above passage. N.B. wings = fringes of cloud. (25)

3. Say how you would explain the meaning of the grammatical term *voice* to a class of children, and what illustrative sentences would you give? (25)

4. Explain the construction and uses of prepositional phrases. (25)

5. Construct words (and explain their meaning) so that each shall contain one of the following prefixes and one of the affixes :—
Ab, tion, Con, ble, Ante, ate, Sub, ive, In, ose, De, fy. (25)

6. Write a short essay upon "The naval supremacy of England" *or* "Strikes" *or* "Waste not, want not." (40)

Third Year—Boys and Girls.

(Answer Questions 1 and 2 and any other two Questions.)

1. Paraphrase this passage :—

Romeo. *Lady* by *yonder* blessed moon I swear
That tips with silver *all* the fruit-tree tops
Juliet. Oh, *swear* not by the moon, the inconstant *moon*
That *monthly* changes in her *circled* orb,
Lest they *that* love *prove* likewise *variable.* (40)

2. Analyse the above passage and parse the words in italics. (35)

3. What do you know of the origin, formation and precise meaning of the following words. Place each of them in a separate sentence of your own making :—Connective, difference, epitaph, photograph, effervesce, intimidate, inhabit, innumerable. (25).

4. If any of the following sentences are faulty correct them :—

I didn't see him nor hear him.
He was opposed against him.
They were wiser than us.
I speak of Milton, a poet than whom none was more learned.
The lake was very frozen yesterday.
We all of us combined together. (25)

5. Give examples of a noun sentence in apposition, as subject, as object, and governed by a preposition. (25)

PENMANSHIP.

ALL YEARS.

Full Marks—40.

Large Hand.—Hieroglyphics. (20)
Small Hand.—Quebec is the Gibraltar of America. (20)

DOMESTIC ECONOMY.

SCHOLARSHIP.

Only three questions to be attempted.

1. What are the special advantages of woollen material for clothing? Is any especial care required in washing woollen articles? (20)

2. In what way have you been taught to relieve any of the school children suffering from the following causes :—A burn, a bruise, a severe cut, an attack of fainting, bleeding at the nose, chilblains? (20)

3. State briefly the cost, the time required, and the method of cooking *two* of the following :—A mackerel, a poached egg, a potato pie, a rice pudding.

4. Describe in a letter to a Pupil-Teacher the advantages of the system carried out in the Post Office Savings Bank. (20)

5. Describe the method of scouring a room. (20)

ARITHMETIC.

FIRST YEAR.—BOYS.

Answer three questions only, including question 2.

1. How many tons of gold at £3·89375 per oz. are contained in a lump worth £113·6975? Ans. ·0008147.....tons. (25)

2. What is a Measure—a Common Measure—and the Greatest Common Measure? Find the G. C. M. of £2 6s. 3d. and £3 16s. 3d. Ans. 1s. 3d. (30)

3. Simplify $\frac{1\frac{3}{5}-\frac{3}{5}}{1\frac{3}{5}+\frac{1}{5}}+\frac{1\frac{3}{5}+\frac{1}{5}}{1\frac{3}{5}-\frac{1}{5}}$ and add together $\dot{7}+\dot{0}\dot{7}+\dot{0}0\dot{7}+0\dot{7}0\dot{7}$.

Ans. $2\frac{4}{99}$; ·9263. (25)

4. Write down all the numbers of 4 digits you can form with the digits 3, 6, 0, 4 and add them together. Ans. 83772. (20)

GIRLS.

1. How many tons, cwts., etc., are there in as many ounces as there are seconds in a week? Ans. 16 tons, 17 cwts., 2 qrs. (30)

2. As for Boys. (30)

3. Make out and duly receipt a bill for:—

		s.	d.
12¼ lbs. of beef at ½d. per oz. - -	Ans.	8	2
14⅘ lbs. of mutton at 7d. per lb. -	,,	8	5
12⅔ lbs. of veal at £1 3s. 4d. per qr.	,,	10	6
18 lbs. of bacon at 3 lbs. for 1s. 10d.	,,	11	0
A ham, 15s. 0d. - - - - -	,,	15	0
	£2	13	1

(20)

4. As for Boys. (20)

SECOND YEAR.

Do three questions only, including the last, if you can.

BOYS ONLY.

1. Find the amount of £50 4s. 2d. for 2 years at 4 per cent. Comp. interest. (25) Ans. £54 6s. 1·3d.

2. A tradesman's prices are 20 per cent. above cost price. If he allows a customer 10 per cent. on his bill, what profit does he make? Ans. 8 per cent. (20)

3. By selling out £4,500 in 5 per cents. at 112½, and investing in the seven per cents., I increase my income by £168 15s. What is the price of the latter stock? Ans. £90. (25)

4. Explain the terms *ratio, premium, par, average,* giving examples.

If I earn in 5 days an average wage of 15s·6, during the first three of which my average wage is 16s. ·3, what will be my wage for the fifth day, if I earn thereon twice as much as on the fourth?

Ans. 19s. ·5. (30)

GIRLS ONLY.

1. Divide £29 into an equal number of half-sovereigns, crowns, half-crowns, shillings, sixpences, and fourpences.

Ans. 30 of each. (25)

2. Sum 2 of first year boys. (20)

3. Reduce $\left\{\frac{1\frac{3}{5}-\frac{1}{5}}{1\frac{3}{5}+\frac{1}{5}}+\frac{1\frac{3}{5}+\frac{1}{5}}{1\frac{3}{5}-\frac{1}{5}}\right\}$ of 1 cwt., 3 qrs., 6 lb., to the vulgar fraction of $4\frac{6}{99}$ lbs.

Ans. $\frac{1}{3}$. (25)

4. Illustrate by a diagram $\frac{1}{2}+\frac{1}{2}=\frac{1}{1}$. Reduce $\frac{2}{5}$ to fractions, having first a numerator 2, and second a denominator 5.

Ans. $\frac{2}{4\frac{2}{3}}, \frac{2\frac{1}{2}}{5}$. (30)

THIRD YEAR.

Answer three questions, incuding the last if you can.

BOYS ONLY.

1. Extract the square root of 30 to 4 places of decimals.

Ans. 5·4772. (15)

2. Find the discount on £78 9s. 9d. due 8 months hence at 6 per cent. Ans. £7 10s. $10\frac{118}{183}$d. (25)

3. Divide $\frac{1\dot{0}\dot{0}}{1\cdot\dot{4}\dot{2}} \times \frac{3\cdot\dot{3}\dot{2}}{2\cdot\dot{4}\dot{7}}$ by such a number as will give $\dot{9}$ as quotient. Ans. 1. (25)

4. (*a*) Prove that a fraction is multiplied by a whole number when its denominator is divided by that number.

(*b*) A man walks a certain distance, and rides back in $5\frac{1}{4}$ hours. He could walk both ways in 7 hours. How long would it take him to ride both ways? Ans. $3\frac{1}{2}$ hours. (35)

GIRLS ONLY.

1. Sum 3 of Boys. (25)

2. A bankrupt can pay 5s. 9d. in the £. If his assets were £500 more he could pay 6s. 6d. Find his debts and assets.
Ans. £13,333 6s. 8d.; £3,833 6s. 8d. (25)

3. An English mile is ·2136 of a German mile. What time will a man who walks a German mile in two hours take to walk an English mile? Ans. 25 minutes $37\frac{3}{47}$ seconds. (20)

4. A draper sold $\frac{5}{18}$ of a roll of ribbon to Ettie, and $\frac{3}{17}$ of the remainder to May, and the latter had $2\frac{1}{2}$ feet less than the former. What was the length of the remainder?
Ans. 12 yards 2 feet 6 inches. (35)

TEACHING.

BOYS AND GIRLS.

Answer two questions on'y.

1. Give as many forms of mental exercise as you can upon the number 36. (20)

2. What are the chief faults to be found in writing the words "Sacks of sovereigns"? (20)

3. What special features should a good Reading Book contain, and why? (20)

THIRD YEAR.

1. Work out notes of a lesson on "*The Thames*" or on "*A Triangle.*" (20)

2. What different methods are employed in working the sum 403 *minus* 317? Which do you prefer? Give reasons. (20.)

3. What place should Dates hold in the Teaching of History? Give reasons, *or* draw up a list of the first twenty object lessons you would give to "*five-year-olds.*" (20)

ALGEBRA.

THIRD YEAR, BOYS.

Answer three questions, including Question 4 if you can.

1. The product of two algebraic expressions is $14a^4-45a^3b+78a^2b^2-45ab^3+14b^4$ and one factor is $7a^2-5ab+2b^2$. What is the other? Ans. $2a^2-5ab+7b^2$ (15).

2. Find the G. C. M. and L. C. M. of $4x^3+4x^2y-9xy^2-9y^3$ and $6x^3+x^2y-16y^2-6y^3$.

Ans. $(x+y)(2x-3y)$; $(x+y)(2x-3y)(2x+3y)(3x+2y)$. (15).

3. (*a*) Simplify $\left(\frac{a}{b}+\frac{b}{a}+\frac{b}{c}+\frac{c}{b}+\frac{a}{c}+\frac{c}{a}+2\right) \div (a+b)(b+c)(c+a)$. Ans. $\frac{1}{abc}$.

(*b*) $\frac{2}{x-1}+\frac{2}{x+1}+\frac{4x}{x^2-x+1}$. Ans. $\frac{4(2x-x^2)}{(x-1)(x^3+1)}$.

4. (*a*) Show that the square of the sum of any number and its reciprocal, together with the square of the difference of the number and its reciprocal, is double the sum of the squares of the number and of its reciprocal.

(*b*) Solve $\frac{6x+7}{9x+1}-\frac{4x+3}{9x+1}=0$. Ans. $x=-\frac{4}{17}$

MENSURATION.

THIRD YEAR, BOYS.

Answer One Question only.

1. A ladder 25 feet long stands upright against a wall; find how far the bottom of the ladder must be pulled out from the wall so as to lower the top one foot. Ans. 7 feet. (20)

2. The parallel sides of a trapezoid are respectively 16 ft. and 20 ft, and the perpendicular distance between them is 5 ft. The two other sides are produced to meet; find the perpendicular distance of the point of intersection from the longer of the two parallel sides. Ans. 25 feet.

EUCLID.

Answer two questions, including Question 3 if you can.

SECOND YEAR, BOYS.

1. If one side of a trangle be produced, the exterior angle is greater than either of the interior opposite angles. (20)

2 If two triangles have two sides of the one equal to two sides of the other each to each, but the angle contained by the two sides of the one less than the angle contained by the two sides equal to them of the other, the base of that which has the less angle is less than the base of the other. (20)

3. Draw a straight line through a given point, to make equal angles with two given straight lines which meet. (30)

THIRD YEAR, BOYS.

1. If one side of a triangle be produced, the exterior angle is equal to the two interior and opposite angles. (20)

2. In any right-angled triangle the square of the hypotenuse is equal to the sum of the squares on the two sides. (20)

3. If two right-angled triangles have the hypotenuse and one side equal, they are equal in all respects. (30)

GEOGRAPHY.

BOYS AND GIRLS.

Answer three questions only, and include Question 5.

FIRST YEAR.

1. Describe the courses of any three rivers on the eastern side of Great Britain, naming the towns on their banks. (25)

2. Where and for what noted are—Rockhampton, Greenock, Killarney, Three Rivers, Boston. (25)

3. Account for the climate and describe the productions of Van Dieman's Land and Labrador. (25)

4. Enumerate the various volcanic belts. (25)

5. Draw a map of the Six Northern Counties or of the Caledonian Canal. (30)

SECOND YEAR.

1. What portions of Europe are inhabited by Teutonic, Celt, and Sclavonian races respectively, and what is the prevalent religion of each race? (25)

2. Describe a land journey from St. Petersburg to Madrid, *or* a voyage from Gibraltar to Bombay. (25)

3. What is the position and importance of each of the following:—Brindisi, Pondicherry, Heligoland, Bucharest, The Sound, Kandy, Cronstadt, Simla, Ajaccio? (25)

4. Explain the relation between longitude and time. When it is noon at Greenwich, what is the time at a place situated $5\frac{1}{2}$ degrees W. Long., and at a place $5\frac{1}{2}$ degrees E. Long. (25)

5. Draw a map of the North Mediterranean Coast from Barcelona to Venice; *or* of the coast from Calais to Barcelona. (30)

THIRD YEAR.

1. Where and what are the following:—Port Said, Sofala, Rangoon, Mecca, Kenia, Nagasaki, Mekong, Peshawar? (25)

2. Compare the flora and fauna of Asia and Africa. (25)

3. Describe a coasting voyage from Canton to Calcutta, *or* a land journey from Zanzibar to Ujiji. (25)

4. What is meant by land and sea breezes? Describe the course of the Japan current.

5. Draw a map of Cape Colony, *or* of the eastern portion of the Mediterranean. (30)

HISTORY.

BOYS AND GIRLS.

Answer three questions only.

FIRST YEAR.

1. What Roman and British relics are still extant in England? (25)

2. Of what importance were Chester, Winchester, Colchester, Dorchester, and Lincoln during the Roman occupation? (25)

3. Who and for what noted were Caradoc, S. Alban, Carausius, Lady of Mercia, Caedmon, Dunstan, Morcar, and Hereward? (30)

4. Compare the characters of the Saxons and Normans. (25)

5. For what were the following years noted :—62, 410, 449, 597, 835, and 1066? (25)

SECOND YEAR.

1. What do you know of any of the following :—Strongbow, Odo, Peter the Hermit, and John of Gaunt? (25)

2. Who were the Lollards, the Lords Ordainers, Tenants in capite, and Justices in Eyre?

3. Give dates of Battle of the Standard, Assize of Clarendon, Magna Charta, Mad Parliament, and first Statute of Labourers. (25)

4. What English Sovereigns from 1066 to 1485 died natural deaths? Who succeeded them? (25)

5. Enumerate the chief provisions of Magna Charta *or* of the Constitutions of Clarendon. (25)

THIRD YEAR.

1. Trace the growth of the English navy up to 1688. (25)

2. What was the foreign policy of Henry VIII., and how was it influenced by Wolsey? (25)

3. What causes combined to render the Tudor sovereigns almost absolute? (25)

4. For what are the following years celebrated :—1535, 1587, 1605, 1628, 1668, and 1688? (25)

5. What were the claims to the throne of Henry VII., James I., and Charles II? Trace the descent of James I from Edward III. (30)

NEEDLEWORK.

Answer one question only.

FIRST YEAR.

1. Cut out and tack together a paper pattern of a nightshirt (full size) for a child six years of age, and mend a hole in stocking material. (60)

2. Make a wristband for a boy's shirt; stitch three inches of it and sew on a button. (60)

SECOND YEAR.

1. Make up in print a short sleeve of a child's nightgown and herring-bone a patch three inches square on coarse flannel. (60)

2. Draw the flat pattern of a woman's nightgown (¼ size) upon sectional paper and make a button-hole in calico. (60)

THIRD YEAR.

1. Cut out in paper and tack together a child's frock bodice; and on coarse linen work a hedge-tear darn. (60)

2. Make and put in a gusset as *for* the side opening of a child's pair of drawers. Show how you would strengthen this side opening.

RECENT EXAMINATION IN DRAWING.

SCHOOL OF 180 BOYS IN CAMBRIDGESHIRE.

THE Inspector arrived at 9.40, and immediately set down the P.Ts. to their examination. He objected to the use of examination papers on which the centre was indicated by a small dot printed on *both* outer edges, and said that the heading should allow for the *full* name of the school to be inserted. In Standards I. and II. the teacher was informed that if the construction was drawn *faintly* it need not be deleted. He recommended the use of straw boards throughout the school.

STANDARD V.—The boys were divided into three sections :—

Freehand.—A glue pot—rather a stiff copy—from a sheet pinned to the B. Board.

Model.—A cube placed in the second position shown in the Illustrated Syllabus.

Geometry.—(1) Describe a circle of 1 inch radius, and divide it into four equal parts. (2) Copy the line AB, and on AB construct an equilateral triangle. (3) Copy the given angle and divide it into two equal parts.

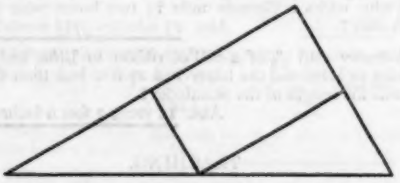
STANDARD IV., divided into three sections :—

Freehand.—A *fleur de lis* from a sheet pinned to the B. Board. Fairly easy.

Geometry (Plane Paper).—(1) Draw this envelope three times the size. (2) Draw this Oxford frame, using a scale of 1 inch to the foot. (Squared Paper.)—(1) A dog kennel. Each square to represent 1 in. (2) A gate. Each square to represent 3 inches.

STANDARD III.—*Freehand*—The outline of a plum, from a copy pinned to the B. Board. A difficult copy.

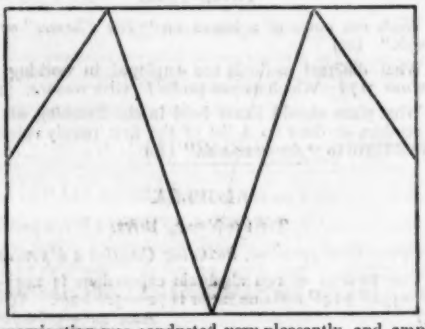
Freehand and Ruler.—The figure was drawn from a sheet pinned to the B. Board, and consisted of a right-angled triangle, having the sides enclosing the right angle bisected and joined to the bisection of the hypotenuse.



It was to be drawn first Freehand and then with Ruler.

Ruler alone.—This section drew from cards. The test consisted of a Greek Fret and a Hexagon, to be copied a little larger.

STANDARDS II. and I.—Each division received a lesson, the same example being used for both. The construction consisted of an oblong four inches by three; each side was bisected, and each portion of the upper four-inch side was again bisected. The example consisted of lines drawn from the outermost divisions of the upper line to the points of bisection of the opposite sides, forming an irregular zig-zag.



The examination was conducted very pleasantly, and ample time was allowed.

REVIEWS.

Physiography. Advanced Course. By the late Andrew Findlater. Revised edition by David Forsyth. London and Edinburgh: W. and R. Chambers, Limited.

In many respects this little book is excellent. It is admirably printed, and the illustrations are neat, and, for the most part well chosen. The book has been arranged to suit the requirements of students preparing for the advanced stage of the examination in physiography of the Science and Art Department. Unfortunately it does not go far enough, and especially is this the case in spectroscopic matters. For this reason, the student who uses the book for the South Kensington examination will have to supplement his reading if he desires to pass.

A couple of errors have been noticed, which it would be well to alter in future editions. Dr. Forsyth says: "Hydrogen and nitrogen gases seem to be the main constituents of these nebulæ." No one now believes that nitrogen manifests itself in nebulæ. Dr. Huggins once supposed the brightest line in the spectrum of nebulæ to be due to nitrogen, but he has abandoned the opinion, and even Prof. Young, who Dr.

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Forsyth quotes so frequently, remarks "it is now certain that, whatever it may be, nitrogen is not the substance." On page 119, Mira Ceti is written ω (Omega) Ceti instead of ο (Omicron) Ceti. But these little slips can easily be remedied. The book contains well-arranged facts pleasantly put, and is therefore worthy of praise; but it falls short of the requirements of the examiners in physiography. This is not only the opinion of the reviewer, but that of teachers who are using the book in their classes. It need hardly be said that this fact does not detract from the intrinsic merit in the slightest; it only asserts that Dr. Forsyth has not brought the information up, or ground it down, to the South Kensington syllabus and examination papers.

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Rome under the Oligarchs: A History of Rome, 202—133 B.C. By A. H. Allcroft, M.A., Oxon, and W. F. Masom, M.A., Lond. London and Cambridge: W. B. Clive and Co.

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[*Owing to the great pressure on our space this month, we are compelled to hold over several Contributions. These will appear in our next Issue as usual.*]

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2. At what rate % will £700 gain £84 in 3 years.

3. A man bought ⅓ of a cargo, of which $\frac{3}{10}$ was sold for £300. What was the value of his share?

4. Simplify $\frac{\frac{3}{5} \times \cdot7825}{\frac{1}{10}}$.

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1. Find the simple interest on £888 for 4½ years at 3·25 % per annum.

2. If 5½ tons of coal cost £4, what would 100 tons cost?

3. Simplify $\frac{\cdot75 + \cdot4 + 1\cdot1 - \cdot6}{\frac{1}{3} \text{ of } \frac{3}{4}}$.

4. Calculate the cost of 8⅓ lbs. of tea at 2⅓ shillings per lb.

Card 14.

1. What is the height of a steeple whose shadow was 112 feet, at the same time that a pole 6 ft. 4 in. cast a shadow of 5 ft. 4in.?

2. Divide ·0001 by ·00002, and 1000 by ·0001.

3. Find the value of ·625 of £1 1s. + ·5̇4̇ of 8s. 3d. + ·0̇2̇7̇ of £2 15s.

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Card 15.

1. Find the value of 119 tons 18 cwts. 1 qr. 11 lbs. at £4·6̇ per ton.

2. A square field contains ·125 square yards. It is divided up into plots, each plot containing ·005 yards. How many plots are there?

3. Find the amount of £2,574 in ⅓ of a year at 4½ % per annum.

4. Required the value of ·28125 of a ton.

Card 16.

1. The G.C.M. of two numbers is 119; their L.C.M. is 11,781; one number is 1,071. Find the other.

2. Simplify $\frac{22}{63} \times 8\frac{1}{3} \times \frac{63}{88} + \frac{33}{51}$ of $1\frac{17}{51} - \frac{33}{61} \times 1\frac{33}{61}$.

3. Subtract 1·003755 quarts from ·04325 bushels. (Answer as a decimal of a pint.)

4. In what time will £10,055 amount to £11,186 3s. 9d. at 2½ % per annum?

Card 17.

1. Take ·6 × $\frac{1}{1\frac{1}{8}}$ × 4 from 1⅓ + ·6̇.

2. Find the value of ⅐ of a guinea + ⅜ of 10s. − ·015 of £1 0s. 10d.

3. Multiply $\frac{217}{1000}$ by 1·001. (Answer in decimals.)

4. In what time will £64 10s. amount to £129 at 5 %?

Card 18.

1. Simplify $\frac{\frac{1}{10} \text{ of } 2\cdot75}{\cdot5 \text{ of } \frac{3}{10}}$.

2. How much can a man save in 1,095 days, whose income is £850 a year, and who spends on an average £1 18s. 3d.?

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Rome under the Oligarchs: A History of Rome, 202—133 B.C. By A. H. Allcroft, M.A., Oxon, and W. F. Masom, M.A., Lond. London and Cambridge: W. B. Clive and Co.

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[*Owing to the great pressure on our space this month, we are compelled to hold over several Contributions. These will appear in our next Issue as usual.*]

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2. Find the value of ·65 of £4 10s. + ·0125 of £5 13s. 4d.

3. Divide 21·3962 by ·527, and 213,962 by ·000527.

4. A bankrupt can pay 6s. 8d. in the £; if his assets were £500 more he could pay 7s. 4d. Find his debts and assets.

Card 10.

1. If 3 cwts. 2 qrs. 6 lbs. 5 ozs. of tobacco can be bought for £92 18s. 9½d., how much of the same kind can be bought for £2 13s. 1d.?

2. Simplify $\frac{\frac{6}{7}\frac{2}{3} - \frac{6}{8}\frac{2}{3}}{\frac{9}{7}\frac{2}{3} - \frac{9}{9}\frac{2}{3}} \times 16\frac{1}{16}$.

3. Find the value of £1·285 − 5·1159 shillings + 6·92 farthings.

4. In what time will £1,005 6s. 8d. amount to £1,156 2s. 8d. at 4 %?

Card 11.

1. Find the principal which in 4½ years at 4½ % will amount to £962.

2. A and B can do a piece of work in 30 days. B can do it himself in 70 days. In what time could A do it alone?

3. Required the simple interest on £875 from March 10th, 1884, to May 22nd, 1885, at 5 %.

4. Find in money the value of $\frac{1}{4}$ of ·6 of a guinea + 3·0875 of 50s. − $\frac{3}{4}$ of $1\frac{1}{9}$ of 3 pence.

Card 12.

1. Reduce ·5346 and ·5346 to vulgar fractions.

2. At what rate % will £700 gain £84 in 3 years.

3. A man bought $\frac{4}{5}$ of a cargo, of which $\frac{3}{2\,0}$ was sold for £300. What was the value of his share?

4. Simplify $\frac{\frac{3}{5} \times \cdot7825}{\frac{1}{2\,0}}$.

Card 13.

1. Find the simple interest on £888 for 4½ years at 3·25 % per annum.

2. If $5\frac{1}{3}$ tons of coal cost £4, what would 100 tons cost?

3. Simplify $\frac{\cdot75 + \cdot4 + 1\cdot1 - \cdot6}{\frac{1}{2} \text{ of } \frac{3}{4}}$.

4. Calculate the cost of $8\frac{3}{8}$ lbs. of tea at $2\frac{1}{2}\frac{1}{5}$ shillings per lb.

Card 14.

1. What is the height of a steeple whose shadow was 112 feet, at the same time that a pole 6 ft. 4 in. cast a shadow of 5 ft. 4in.?

2. Divide ·0001 by ·00002, and 1000 by ·0001.

3. Find the value of ·625 of £1 1s. + ·5̇4̇ of 8s. 3d. + ·027̇ of £2 15s.

4. Express the difference between $\frac{1}{8}$ of 5s. 9d. and $\frac{1}{7}$ of 6s. 4d. as the decimal of 10s. 6d.

Card 15.

1. Find the value of 119 tons 18 cwts. 1 qr. 11 lbs. at £4·6̇ per ton.

2. A square field contains ·125 square yards. It is divided up into plots, each plot containing ·005 yards. How many plots are there?

3. Find the amount of £2,574 in $\frac{1}{3}$ of a year at 4½ % per annum.

4. Required the value of ·28125 of a ton.

Card 16.

1. The G.C.M. of two numbers is 119; their L.C.M. is 11,781; one number is 1,071. Find the other.

2. Simplify $\frac{2\,7}{6\,5} \times 8\frac{1}{3} \times \frac{5\,1}{7\,4} + \frac{3\,3}{2\,7}$ of $1\frac{1\,7}{2\,1} - \frac{3\,8}{6\,1} \times 1\frac{3\,3}{9\,1}$.

3. Subtract 1·003755 quarts from ·04325 bushels. (Answer as a decimal of a pint.)

4. In what time will £10,055 amount to £11,186 3s. 9d. at 2½ % per annum?

Card 17.

1. Take ·6 × $\frac{1\,4}{2\,1}$ × 4 from $1\frac{1}{9} + \cdot6̇$.

2. Find the value of $\frac{4}{7}$ of a guinea + $\frac{3}{8}$ of 10s. − ·015 of £1 0s. 10d.

3. Multiply $\frac{3\,1\,7}{1\,0\,0\,0}$ by 1·001. (Answer in decimals.)

4. In what time will £64 10s. amount to £129 at 5 %?

Card 18.

1. Simplify $\frac{\frac{1}{2\,0} \text{ of } 2\cdot75}{\cdot5 \text{ of } \frac{3}{2\,0}}$.

2. How much can a man save in 1,095 days, whose income is £850 a year, and who spends on an average £1 18s. 3d.?

3. At what rate % will £256·25 gain £37·5 in 7 years?

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1. Find the value of $\cdot5 + \frac{2}{3} + \frac{6}{8} + \frac{7}{12}$.

2. Find the value of 3 tons 2·5 qrs. at £·875 per cwt.

3. A man sold $\frac{1}{4}$ of his sheep to one man, $\dot{6}$ to another, and had 100 left. How many had he at first?

4. In what time will a £20 note gain £10 at 5 % per annum simple interest?

Card 30.

1. Simplify 1·26 of 66·$\dot{6}$ + 5·2 of 1·0375.

2. Find the simple interest on £500$\frac{1}{2}$ + 500$\frac{1}{2}$ shillings at 2$\frac{1}{2}$ % for 4$\frac{1}{2}$ years.

3. Express 1 florin and 10d. as a decimal of $\dot{3}$ of a £.

4. A can do a piece of work in 5 days, B can do it in 4 days: how long will they take to do it if they work together?

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1. $1\frac{333}{1000}$.
2. ·00142 +.
3. 40 yards.
4. $3\frac{3}{16}$ %.

Card 2.

1. $4\frac{12}{21}$.
2. $\frac{25}{28}$.
3. £73 6s. 8d.
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4. 10 years.

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2. $2\frac{1}{2}$ %.
3. $\frac{8}{9}$.
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1. 3s. $7\frac{189}{191}$d.
2. $8\frac{140}{243}$ %.
3. 8·088.
4. 1 cwt. 3 qrs. $16\frac{8}{9}$ lbs.

Card 6.

1. 3421440.
2. 13·643.
3. 5 cwt. 2 qrs. 14 lbs.
4. 20 years.

Card 7.

1. $4\frac{8}{11}$ %.
2. 24,950,000.
3. 50·778125.
4. $\frac{21}{40}$; ·525.

Card 8.

1. $\frac{1}{4}$.
2. ·06975.
3. 1287.
4. $10\frac{11}{12}$.

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2. 40·6 and 406,000,000.
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1. 133 feet.
2. 5 and 10,000,000.
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4. ·00725.

Card 15.

1. £559 12s. $3\frac{1}{2}$d.
2. 25 plots.
3. £2,597 3s. 3·84d.
4. 5 cwt. 2 qrs. 14 lbs.

Card 16.

1. 1,309.
2. $33\frac{144}{289}$.
3. ·76049.
4. $4\frac{1}{2}$ years.

Card 17.

1. $\frac{10}{13}$.
2. £1 19s. $5\frac{1}{2}$.
3. ·3172530.
4. 20 years.

Card 18.

1. $1\frac{1}{9}$.
2. £455 16s. 3d.
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4. ·63.

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2. 440 yards.
3. £1 9s. $6\frac{1}{2}$d.
4. 5 years.

Card 24.

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2. 17s. 6·2d.
3. £105 2s. 4d.
4. $\frac{1}{18}$.

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2. £527 17s. 6d.
3. $736\frac{3}{22}$ yards.
4. ·083.

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3. £623 15s. $11\frac{5}{8}$d.
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1. $2\frac{37}{104}$ years.
2. $\frac{1}{2}$ the distance.
3. $32\frac{888}{889}$.
4. ·6651.

Card 29.

1. $2\frac{1}{2}$.
2. £53 0s. $11\frac{1}{2}$d.
3. 1,200 sheep.
4. 10 years.

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2. £55 3s. $7\frac{33}{100}$d.
3. ·425.
4. $2\frac{3}{8}$ days.

N.B.—No teacher can win more than one prize in six months.

acher who is the **FIRST** to point out an Error in the above Answers.

., PILGRIM STREET, LUDGATE HILL, E.C.

Card 19.

1. In what time will £750 amount to £846 at $3\frac{1}{3}$ % per annum.

2. $\frac{1}{16}$ of an estate = $\cdot0\dot{3}$ of £85,370. Find the value of the estate.

3. If I receive £$2\frac{3}{8}$ and £$\cdot41\dot{6}$, and pay £2 14s. $4\frac{1}{2}$d., what fraction of a £ is left?

4. When eggs are $1\frac{1}{2}$d. each, how many dozen could be bought for 3·5 guineas?

Card 20.

1. Reduce $\cdot\dot{6}$, $\cdot\dot{4}\dot{7}$, and $\cdot8\dot{2}\dot{5}$, to vulgar fractions.

2. Find the value of ·75 of 20s., and ·96875 of 240 pence.

3. If 28 sheep can be bought for £63, how many can be bought for £27?

4. Find the simple interest on £287 15s. 10d. for 12 months, at 5 % per annum.

Card 21.

1. At what rate % will £846 10s. double itself in 20 years?

2. Reduce $\cdot3\dot{0}946\dot{5}93\dot{}$ to its lowest term.

3. Add together ·425 tons ·356 cwts. ·54 qrs. and 100 lbs.

4. A bankrupt owes his creditors £59 19s. $7\frac{3}{4}$d., and he is able to pay 14s. $7\frac{3}{4}$d. in the £. What do his creditors lose?

Card 22.

1. Simplify $\frac{\frac{5}{16} + (\frac{7}{13} \text{ of } 3\frac{1}{4}) - (\frac{7}{8} \text{ of } \frac{1}{7})}{\frac{1}{4}}$.

2. Divide £$9\frac{1}{2}$ among A, B, and C, giving A $2\frac{1}{2}$ times more than B or C.

3. From ·125 take $\frac{1}{11}$. What must be added to the answer to make $\cdot1\dot{6}$?

4. What will £$136\frac{3}{4}$ amount to in 1·125 years at $2\frac{1}{2}$ %?

Card 23.

1. Reduce 13 ft. $11\frac{1}{2}$ in. to the decimal of ·5 miles.

2. Find the value of £$\cdot6\dot{2}5$ + 1·25 guineas − ·75 crowns − 5·475 shillings + ·5 pence.

3. A can run 120 yards in 2 minutes, B can run 160 yards in 2 minutes. How far is A behind when B has run a mile?

4. In what time will $1\frac{1}{2}$d. amount to 3d. at 20 % per annum?

Card 24.

1. Find the simple interest on £600 for 4 years 11 months at 4·5 %.

2. Find the value of $\frac{3}{5}$ of 6s. 8d.; $\frac{1}{8}$ of £3 3s.; $5\frac{3}{4}$d.

3. 2·875 miles at £36 11s. 3d. per mile.

4. From $\cdot\dot{6} + \frac{1}{6}$ take $\cdot\dot{1}$.

Card 25.

1. If a boy earns £5 12s. 8d. in a year, how much will he earn in $\frac{9}{13}$ of a year?

2. Multiply $\frac{1}{2}$ of 7·875 by twice 2·6.

3. If I pay 1s. 7d. for travelling $12\frac{1}{2}$ miles, how much shall I pay for travelling 21·875 miles?

4. Add together ·6 of a sovereign; ·75 of $\frac{1}{2}$ £; $\frac{4}{5}$ of ·5 of 5s.; $\cdot8\dot{3}$ of £1.

Card 26.

1. Multiply 75·043 by 366·3 and divide the answer by 2·7491.

2. After paying income tax of 8d. in the £ I found I had £510 5s. 7d. left. What was my income?

3. If $682\frac{1}{4}$ yards cost £352 16s. 8d., how many yards can I get for £396 18s. 9d.?

4. Reduce the difference between $6\cdot4\dot{5}$ of $8\frac{1}{4}$ guineas and $6\cdot4\dot{5}$ of £$8\frac{1}{4}$ to the decimal of £31 17s.

Card 27.

1. Find the value of £17 + ·1275 shillings + $\dot{4}$ of a guinea.

2. If $\frac{3}{13}$ of a ship be worth £7,057 10s. 6d., how much is $\frac{3}{5}$ of $\frac{3}{4}$ of it worth?

3. Find the value of 2s. $7\frac{1}{2}$d. × 4752·75.

4. In what time will £57 16s. 8d. amount to £75 19s. 3d. at $4\frac{1}{2}$ %?

Card 28.

1. In how many years will £260 take to amount to £286 10s. at 4 % simple interest?

2. If 1·2 tons be carried a certain distance for 15s. 6d., how far ought 48 cwt. be carried for the same sum?

3. Simplify $\frac{7\cdot\dot{5}\dot{7}}{\cdot6 - \cdot05} + 19\frac{17}{21}$.

4. Reduce $13\cdot2\dot{3}\dot{1}$ shillings to the decimal of £1.

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Card 1.

1. Simplify $\frac{\cdot 125 + 6\frac{1}{4}}{7\frac{1}{2} - 1\frac{5}{8}}$.

2. Reduce $\frac{1}{16}$ of 5s. to the dec. of £4 4s.

3. How much paper, $2\frac{1}{2}$ ft. wide, will be required to paper two sides of a room, each 5 yards long and 10 feet high?

4. At what rate % will £316 13s. 4d. gain £40 in 16 years?

Card 2.

1. Simplify the following $\frac{1\frac{1}{2} - \frac{1}{6}}{\cdot 3} + \frac{5}{8} \div 3\cdot 75$.

2. Add together the greatest and least of the following fractions:— ·75, $\frac{1}{3}$, $\frac{5}{7}$, and $\frac{1}{7}$.

3. A tradesman paid 3s. 4d. in the £ on £440. How much did he pay?

4. Find the simple interest on £168 12s. for $\frac{5}{17}$ of a year, at 6·5 %.

Card 3.

1. In what time will £135 10s. amount to £149 14s. 6d. at $2\frac{1}{2}$ % per annum?

2. If £2 10s. will buy 3·3 gallons of wine, how many gallons of wine can I get for £$4\frac{1}{2}$?

3. If I put £40 in the savings bank for a year, and then draw £43, what is that %?

4. In what time will £45 18s. 11d. double itself at 10 %?

Card 4.

1. Find the value of (·4952 of 7s. 6d.) × 12·3932.

2. At what rate % will £680 gain £51 in three 3 years?

3. What number added to $\cdot 875 + \frac{5}{17}$ will give 2·125?

4. If ·416 of a business be worth £650, what will $\frac{1}{5}$ of it be worth?

Card 5.

1. $\frac{5\frac{1}{4} + 6\frac{1}{2}}{4\frac{1}{8} + 6\frac{1}{4}}$ of 3s. 4d.

2. At what rate % will £270 gain £98 4s. in $4\frac{1}{2}$ years simple interest?

3. Divide $\frac{1}{8}\frac{5}{6}$ by ·05750.

4. If 112 lbs. of coffee cost £$5\frac{3}{16}$, how much coffee could be bought for £10·64?

Card 6.

1. If 24 coins cover a space of 44 square inches, how many coins would cover a space of 160 poles?

2. Simplify $\frac{\cdot 0035 \times 97\cdot 45}{\frac{1}{4\cdot 6}}$.

3. Find the value of ·28125 of ·2 of 100 cwts.

4. How long will £45 16s. be in amounting to £91 12s. at 5 %?

Card 7.

1. A man paid £130 12s. 6d. for the loan of £500 for $5\frac{1}{2}$ years. Find rate %.

2. In a certain year 72,355 people emigrated from a country at the rate of 2·9 per 1,000. Find the population.

3. Add ·643, ·0075, ·9744, and divide by ·032.

4. What fraction (vulgar and decimal) of 8s. 4d. is 1·75 of 2s. 6d.?

Card 8.

1. Reduce $\frac{3}{16}$ of £1 6s. 8d. + $\frac{3}{16}$ of 10s. 6d. + $\frac{3}{16}$ of 1s. + $\frac{2}{15}$ of £1 to the fraction of £2 11s. 5d.

2. Divide 7·32375 by 105 by factors (3 × 5 × 7).

3. Required the L.C.M. of 99, 117, and 143.

4. Simplify $3\frac{1}{6} - \frac{5}{7} + 7\frac{5}{13} - 8\frac{3}{14} + 9\frac{11}{16}$.

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